W. B. MEACHAM.

W. B. MEACHAM.

PAIN

ITS CAUSATION AND DIAGNOSTIC SIGNIFICANCE IN INTERNAL DISEASES

BY

DR. RUDOLPH SCHMIDT

PHYSICIAN TO THE ROYAL EMPRESS ELIZABETH HOSPITAL, VIENNA

TRANSLATED AND EDITED FROM THE SECOND ENLARGED AND REVISED GERMAN EDITION BY

KARL M. VOGEL, M.D.

ASSISTANT PROFESSOR OF CLINICAL PATHOLOGY, COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY; CLINICAL PATHOLOGIST AND ASSISTANT ATTENDING PHYSICIAN, ST. LUKE'S HOSPITAL

AND

HANS ZINSSER, A.M., M.D.

PROFESSOR OF BACTERIOLOGY, LELAND STANFORD JR. UNIVERSITY

SECOND EDITION

PHILADELPHIA & LONDON

J. B. LIPPINCOTT COMPANY

COPYRIGHT, 1908
BY J. B. LIPPINCOTT COMPANY

COPYRIGHT, 1911
BY J. B. LIPPINCOTT COMPANY

Manufactured by J. B. Lippincott Company
The Washington Square Press, Philadelphia, U. S. A.

Preface to the Second Edition

In the preface to the first edition I expressed the wish that the book might serve as a guide in the rapid and correct interpretation and successful treatment of the pain occurring in internal diseases. The necessity for a second edition, and the translation of the work into English and Italian may be taken as showing that this hope has been fulfilled.

In preparing the new edition it seemed to me that it would be advantageous to illustrate the abstract discussions by introducing here and there short case histories bearing on the topics under consideration. In many sections, for example in the chapters on headache and on gastralgia, further observation has made it possible to treat the subject matter more broadly and at greater length.

May this new presentation of the subject also receive a favorable reception and useful application.

Schmidt.

Translators' Preface

In undertaking a systematic analysis of pain Dr. Schmidt has performed a useful service. The great difficulties attending such an analysis hardly need to be emphasized to the general practitioner, who is so often called upon to interpret the subjective complaint in terms of the temperament and individuality of the patient. In fulfilling his task the author has throughout tempered his deductions from actual pathological processes with a careful critical consideration of the functional elements which, in the phenomena of pain, so frequently cloud the clinical picture. Wherever possible, however, he has based his conclusions upon the more exact factors of anatomical structure and pathological change. It is self-evident that in the consideration of a symptom so purely subjective, composed of such complex psychological and pathological elements, the final interpretation can be made only on the basis of careful clinical observation. The subtle differences, too, which may exist between individual cases of similar conditions preclude the possibility of formulating absolute rules. The author can but point the way to correct analyses and logical deduction. Dr. Schmidt, in the performance of his task, calls upon the experience of many years with a huge clinical material. The thoroughness and concise-

ness with which he has presented his subject have seemed to the translators to justify the preparation of the little volume for the use of American members of the profession. For the sake of completeness they have added a chapter (X) embodying a brief presentation of Head's researches on referred pains and a series of diagrams showing some of the commoner seats of pain or tenderness in visceral disease.

In preparing the second enlarged edition of the book Dr. Schmidt has performed the work of revision with more than ordinary thoroughness. Some of the chapters have been almost entirely rewritten, and in nearly every section more or less radical changes are to be found. The interest of the text has been greatly increased by the addition of numerous case histories illustrating the discussions of the theoretical questions involved, and in many other ways the author has sought to make the work still better adapted to the needs of the practitioner and the student.

Preface to the First Edition

The manifestations of disease that are apparent to the senses of the examiner, and therefore susceptible of objective estimation, are, naturally, especially valuable for diagnostic purposes. Modern medical research accordingly strives to facilitate the solution of diagnostic problems by investigations tending in this direction, such as the study of serum pathology and radiology. It may therefore appear almost like a step backward to lay as much stress on a phenomenon that is so purely objective in nature, and so dependent on the observations of the patient himself, as will be done in the following discussion of the symptom of pain.

In this undertaking I have been actuated by the following considerations: In the first place, the objective evidences of disease often do not appear until the malady has reached a certain degree of development, whereas pain is not rarely present at its very inception. Furthermore, under the conditions of actual practice a comprehensive investigation of all the objective symptoms is frequently a matter of great difficulty owing to the absence of the necessary facilities, and therefore a careful consideration of the patient's own sensations is absolutely essential. Lastly, it is frequently this very symptom of pain that impels the patient to seek medical

advice, and it will therefore be the starting point of the diagnostic train of reasoning, while its correct interpretation is the first requisite to the institution of a suitable form of treatment.

On the other hand, both during the ten years of my service in the clinic of my honored instructor, Hofrat von Neusser, which brought me in constant contact with the younger members of the staff, and in the course of my long-continued activity as a post-graduate instructor, I have convinced myself that even among those having satisfactory command of the methods of objective examination there is a great deficiency in the ability to make use of the information conveyed by the manifestations of pain. A realization of this lack was another reason for the preparation of the present volume.

The work is intended especially to afford a general view that will enable rapid orientation in the individual case, and I therefore did not deem it advisable to impair its continuity by the introduction of references to the literature or of polemical discussions. The adoption of a more or less dogmatic method of presentation seemed justified by my long-standing hospital connection, which has also involved much experience in teaching.

In discussing the manifestations of pain it has seemed to me that in addition to the organic processes to which they were due and the topographical factors underlying their projection externally, their relationship to function was especially important

from the standpoint of facilitating diagnosis. The investigation of painful conditions from this point of view leads to a more intimate comprehension of their pathogenesis and therefore to greater success in treatment.

May the book fulfil the purpose for which it was written, of serving as a guide in the rapid and correct interpretation and successful treatment of the pain occurring in internal diseases.

SCHMIDT.

Contents

PAGE

PREFACE TO THE SECOND EDITION 3
TRANSLATORS' PREFACE 5
PREFACE TO THE FIRST EDITION 7

CHAPTER I.

THE SENSATION OF PAIN 15

CHAPTER II.

THE FUNCTIONAL MODIFICATION OF PAIN 24
The Influence of Position 24
The Influence of Motion 28
The Influence of Pressure 32
The Influence of Food 36
The Influence of Drugs and Chemicals 41
The Influence of Organic Function 44

CHAPTER III.

TOPOGRAPHY IN ITS RELATION TO PAIN 50
The Shoulder 51
Retrosternal Region 53
Scapula and Interscapular Region 54
The Epigastrium 56
The Abdomen below the Umbilicus 60
The Lumbar Region (Symmetrical) 61
The Lumbar Region (Unilateral) and the Flanks 63
Atypical Abdominal Pains 63

CHAPTER IV.

QUALITY AND TIME OF OCCURRENCE 71
Colicky Pains 71
Nocturnal Pains 73

CHAPTER V.

THE NERVOUS SYSTEM 76
Headache 76
Due to Elevations of Intracranial Pressure 79
Caused by Chemical Poisons 85
Of Reflex Nature 88
Neuralgias Involving the General Nervous System 97
The Face 102
The Occipital Region and Nape of the Neck 104
The Arm 105
Intercostal Spaces, Including Upper Abdomen 107
Flanks and Lower Abdominal Region 109
Lower Extremities 110
Neuralgias, Sympathetic System and Vagus 113

CHAPTER VI.

Organs of Motion 119
Joint Pains or Arthralgias 119
Muscular Pains or Myalgias 124
Bone Pains or Ostalgias 131

CHAPTER VII.

Digestive System 140
Gastralgias 140
Irritable Weakness of Nervous System 144
Direct Causes 144
Reflex Causes 147
Gastric Ulcer 154
The Colic of Pyloric Stenosis 175
Gastric Cancer 187
Intestinal Ulceration 197
Diseases of the Appendix 206
Lead Colic 217
Malignant New Growths of the Intestine 224
Liver 233
Gall-Bladder Colic 236
Pains without Colic 254
Distention and Inflammation of Capsule 256
Pancreas 268

CHAPTER VIII.

Urinary System and Spleen 277
Kidney 277
True Kidney Pains 277
Muscular Spasm, Urogenital Tract 291
Urinary Bladder 302
Spleen 306

CHAPTER IX.

Respiratory and Circulatory Systems 312
The Lungs 312
Aorta 322
Peripheral Vessels 345

CHAPTER X.

Cutaneous Tenderness in Visceral Disease 350

List of Illustrations

(At End of the Text)

FIG.

1. Diagram, anterior view of the human body showing segmental distribution of referred pain and tenderness in visceral disease.
2. Diagram, posterior view of the human body showing segmental distribution of referred pain and tenderness in visceral disease.
3. Diagram, lateral view of the human body showing segmental distribution of referred pain and tenderness in visceral disease.
4. Diagram of head and neck, showing areas of referred pain and tenderness related to visceral disease or to affections of the head and neck.
5. Possible areas of pain or tenderness in diseases of the nervous system, etc.
6. Possible areas of pain or tenderness in diseases of the nervous system, etc.
7. Possible areas of pain or tenderness in diseases of the abdominal organs, etc.
8. Possible areas of pain or tenderness in diseases of the abdominal organs, etc.
9. Possible areas of pain or tenderness in diseases of the abdominal organs, etc.
10. Possible areas of pain or tenderness in diseases of the abdominal organs, etc.
11. Possible areas of pain or tenderness in diseases of the abdominal organs, etc.
12. Possible areas of pain or tenderness in diseases of the lungs and pleura.
13. Possible areas of pain or tenderness in diseases of the lungs and pleura.

FIG.

14. Possible areas of pain or tenderness in diseases of the lungs and pleura.
15. Possible areas of pain or tenderness in diseases of the heart and vessels.
16. Possible areas of pain or tenderness in diseases of the heart and vessels.
17. Possible areas of pain or tenderness in diseases of the heart and vessels.
18. Possible areas of pain or tenderness in diseases of the heart and vessels.

PAIN

ITS CAUSATION AND DIAGNOSTIC SIGNIFICANCE IN INTERNAL DISEASES

CHAPTER I.

The Sensation of Pain.

In order to combat successfully a painful sensation manifested by a patient, of whatever sort it may be, it is necessary first to obtain a clear insight into its sources of origin. The more deeply we are able to penetrate into these the more successful and to the point will be our therapeutic measures. A fundamental principle in such an objective study is the analysis of the painful sensation into its various elements, its relations to space and to time, its characteristic qualitative shading, its area of distribution, associated manifestations, etc.

Topography.—The analysis of a pain may most suitably be commenced by determining its topographical characteristics. In order to do this it should be made a rule always to have the patient point out exactly the spot or the region in which the pain is felt, and specify whether it is superficial or deep seated. Vague statements, such as pain in the stomach, in the liver, etc., are of little value and are frequently associated with totally erroneous con-

ceptions regarding the situation of the organ in question, so that they serve only to lead astray.

Where the pain is a radiating one it is necessary to differentiate between the painful focus and its peripheral radiations. In such cases it will usually be found that the focus—often from the diagnostic point of view the most important point—coincides with the area in which the pain was localized at the beginning of the attack. Of no less significance than the location of the painful focus, which ordinarily is at least in proximity to the etiological point of origin, are the radiations of the pain, especially in cases in which there is no ground for assuming a neuropathic tendency in the patient. If the opposite should be the case, however, it is advisable not to attach undue importance to the direction of radiation from the standpoint of differential diagnosis. Under these conditions one must be prepared to encounter atypical and wholly irregular, bizarre radiations. The extent of the area involved by the radiation of the pain in paroxysms such as those of biliary and ureteral colic, etc., frequently appears to be directly proportional to the intensity of the neuropathic tendency. Under such conditions pain in unrelated regions may easily appear. For example, biliary colic may be associated with pseudo-angina, and thus present the anomalous picture of an attack of colic with apparent radiation into the left upper extremity.

In considering the topography it is also essential to take into account multiplicity or symmetry of the

pain, if present. These features in connection with neuralgias, arthralgias, and ostalgias indicate a broader etiological basis, such as a disorder of metabolism, and speak against a purely local causation.

Time.—A natural sequel of a consideration of the location of the pain is that of the time of its appearance. Not infrequently the onset of the pain is associated with some definite hour of the day, or exhibits a regular dependence on certain occurrences, such as the ingestion of food. Or it may appear at some stated time of the day (for example, nocturnal pain), and it is then our task to determine the factors underlying this regularity in recurrence. Now and then a relation to larger units of time, such as the seasons, or distinct phases in bodily development, may be observed and open up perspectives in the direction of the manner of causation. The duration of the painful sensation must also receive due attention.

Intensity.—The purely quantitative variations, of course, depend on the intensity of the stimulus in question, but not less so on the sensitiveness of the registering apparatus, that is, the patient's psychical characteristics, so that the same etiological stimulus may appear endurable to one, but may seriously disturb the psychical equilibrium of another. This double dependence of the intensity of the painful sensation on stimulus and irritability, and the impossibility of projecting externally the physicochemical events in the sensory nerve substance that take place when pain is experienced, render illusory attempts at the quantitative estimation

of the sensation for diagnostic purposes. None the less, we are not entirely without means of control, and can make use of these in cases in which doubt arises regarding the credibility of the patient.

Simulation and Exaggeration.—While in some cases there may be an actual attempt to mislead the examiner, more frequently one encounters individuals whose neuropathic constitution causes every painful stimulus to be perceived in greatly magnified form. With such persons the hypersusceptibility of their receptive centres may result in even the slightest disturbances, possibly vasomotor or nutritional in nature, being recorded as painful sensations. This is probably the explanation of the vague "rheumatoid" pains so frequently complained of by neurasthenics. Neuropathic individuals like to speak of their sensations in the superlative, even when these are actually of slight intensity. In such cases it is well to avoid much questioning and to pay more attention to the facial expression while testing for sensitiveness—of the abdomen, for example—at the same time distracting the patient's mind by conversation, etc. One then often notes the absence of the troubled expression and general restlessness that characterize the existence of pain in normal persons. Due consideration must be given to the reflexes of expression in endeavoring to estimate the severity of pain.

Experience shows that intense and persistent pain in the course of time nearly always leads to more or less serious disturbances in the condition

of the body as a whole, so that disorders of nutrition are produced and loss of weight results. In some cases, therefore, systematic observations of the patient's weight may serve as a means of control in this regard. If there is no loss of weight, and especially if there should be a gain, the existence of persistent intense pain is extremely unlikely. When paroxysmal pain is complained of, the determination of the pulse rate and of the blood-pressure is to be recommended. This should be done both in the interval when the pain has subsided and at the height of the paroxysm. Fluctuations either upward or downward may give a useful hint, but as it is largely a question of vasomotor control, which is subject to great individual variations, hard and fast rules cannot be laid down.

I have seen attacks of lead colic which were attended by a rise in blood-pressure, but this is not necessarily the case. In one case of biliary colic there was during the seizure a fall in blood-pressure from 85 mm. of Hg. (Gärtner) to 55 mm. without the patient's going into collapse.

In dealing with patients suspected of malingering I would suggest that if pain is complained of on pressure, the size of the pupils be observed in order to detect any possible increase in dilatation that may follow the painful stimulus (sympathetic reflex). If this reflex is present there is no doubt of the veracity of the patient in stating that he is experiencing pain. It is advisable, however, to obtain some insight into the patient's susceptibility to reflexes of this sort by the production of an artificial pain, *e.g.,* by pinching. Theoretically,

this procedure even offers the possibility of obtaining an insight into the intensity of the original pain by observing the degree of stimulation necessary to evoke the same reflex, assuming that equal stimuli produce reflexes of equal intensities. Reflex phenomena may be used in other ways as means of control in this direction. Such a one is the unilateral increase in the abdominal reflex which leads to the symptom of muscular rigidity (*défense musculaire*) occurring in abdominal conditions. True pressure tenderness, due to acute appendicitis, is never accompanied by an increase in the superficial abdominal reflex on the right side. If a patient complaining of such tenderness also exhibits a marked increase in this reflex he is probably neuropathic and not suffering from an acute inflammatory process about the appendix.

Quality.—Patients accustomed to close self-observation often supply information in regard to the quality of their pains. Not infrequently light may be thrown on the pathogenesis or nature of these pains through the description which the patient gives of them as being boring, piercing, colicky, etc. Pain resulting from muscular spasm is often experienced as a "cramp" or "griping." In cases of overdistention of hollow muscular organs this phenomenon may give its characteristic shading to the pain, and the pain of aneurysmal erosion, for example, is often described "as if something was boring" or as being "pounding" in nature. Abdominal pains must always be considered with re-

gard to the presence of a colicky character. The distinctive feature of this lies in its wave-like increase and decrease, frequently accompanied by a sensation of griping, "tying up in a knot," or a feeling of overdistention.

Modifying Factors.—The exact analysis of the pain furthermore demands the accurate determination of all of the factors which influence the intensity of the sensation, either in the positive or the negative sense. Such modifying factors are intimately connected with the causative condition and are therefore of the greatest importance from the diagnostic point of view. In this connection stimuli of general nature must especially be considered.

a. *Psychical.*—Excitement, diversion of attention, suggestion either in the waking condition or under hypnosis, etc. It is evident that painful sensations that have what may be termed a psychical origin and from this centre are projected to some one zone of the periphery, such as some of the pains of hysteria, are particularly susceptible to psychical modification. The same thing is true of pains which are peripheral and organic in origin but which are brought prominently into the foreground only as the result of abnormal irritability of the central receptive organs. In such cases diverting the attention through suitable occupation or pastimes, change of surroundings, etc., has an anodyne action. Such "negative" psychical modifications, *i.e.,* diminution in the pain effected by these means, may if well defined have some differential value, and indicate a

psychical component in the condition. On the other hand, a "positive" psychical modification, manifesting itself in increase of the pain, is hardly ever of service in distinguishing between functional and organic disorders. The effect of unpleasant emotions is to increase the susceptibility to disagreeable impressions, and all painful stimuli are therefore experienced with greater intensity. Furthermore, the various organic functions, such for example as that of digestion, are largely subject to such influences. It is not astonishing therefore to see the symptoms attending a gastric ulcer increase under excitement, or to note that an attack of biliary colic may follow a fit of anger. It would be quite wrong, however, to conclude in such cases that the symptoms were purely functional in nature. At the most it is justifiable only to assume the existence of a contributing component of this character.

b. *Mechanical.*—Position of the body, motion, solid food, percussion, massage, pressure, concussion, etc.

c. *Thermic.*—Changes of weather, draughts, etc.

d. *Electrical.*

e. *Chemical.*—1. Dietetic.

2. Remedial: local or general.

Whenever the pain appears to be dependent on certain organic conditions or organic functions it will nearly always be possible on careful consideration to discover the primary causative factor, either in the group of the mechanical or of the chemical cell stimuli.

Accompanying Manifestations.—Finally, it must not be forgotten that attention should be directed to any possible associated manifestations, whether these are of a purely subjective nature or are also susceptible of objective study. Frequently, of course, these are only remote in nature, such for example as the vomiting or constipation accompanying painful abdominal seizures of the most varied types, but sometimes they may also be interpreted as actual local symptoms (peristalsis, diarrhœa, dysuria, icterus, bleeding from the genitals, etc.).

By following the preceding scheme it will often be possible to make a rapid diagnosis and to obtain a point of departure for therapeutic measures. At least the diagnostic possibilities will be narrowed and the physical examination or the laboratory investigations may be concentrated in a smaller domain. This is as it should be, for not only accuracy but also promptness is desirable in diagnosis.

CHAPTER II.

The Functional Modification of Pain.

THE INFLUENCE OF POSITION.

In discussing the pain associated with the various organs it is often desirable to emphasize its dependence on definite positions of the body, such as the dorsal, the lateral, etc., which frequently appear to bear a distinct relationship to the sensation. Observations of this sort lead to the characterization of certain "positions of maximum pain," which term may be applied to those positions which give rise to a pain which previously did not exist or which increase the intensity of a pain already present. In so far as the painful position depends on tenderness to pressure of superficial structures, as in joint affections, etc., it has little diagnostic interest, and only those instances are to be discussed in which such external causation of the pain is not involved. In gastric ulcer the existence of a painful position has been accorded a somewhat unjustifiable degree of importance from the standpoint of differential diagnosis, and for this reason the interpretation of the symptom is not always clear cut. This subject will be discussed later on in its proper place.

As a matter of fact, painful positions may be discovered in connection with the pain complexes of the most varied organs, and this therefore points

to uniformity in the mechanism of their origin. For example, in the discussion of special organs reference will be made to the occurrence of painful positions in diseases of the gall-bladder, of the appendix, in abdominal tumors, aneurysms, pericarditis, etc. In the majority of cases the most general cause of pain is to be sought for in a change of position of the diseased organ, such as occurs in certain positions of the body. All the organs, including new growths, are rather loosely packed in the body cavities, and the firmness of their fixation is very variable, as is shown in enteroptosis for example.

Painful traction on diseased organs is likely to result (especially in cases of inflammatory processes in the immediate neighborhood of the structures involved, as in perigastritis, appendicitis, periaortitis, etc.) in those positions of the body in which the organ is deprived of its firm support. This is ordinarily the case in the position on the side opposed to the lesion, and the resulting pain will depend on the degree of sensibility caused by the inflammation and on the intensity of the traction, *i.e.*, on the weight and mobility of the displaced mass. Of course other factors also come into play, such as pressure on neighboring nerve trunks, as in aneurysms, tumors, etc., as well as secondary pressure effects on muscular hollow organs like the stomach, intestine, ureter, etc. A special mechanism depending on the local peculiarities of the tissues involved underlies the position of maximum pain in certain diseases of the aorta or the coronary arteries. It is well

known that in some cases of these the horizontal position may give rise to the onset of painful attacks of angina pectoris. In these affections the causative factor is probably to be found in the alterations in the circulation produced by the change in position, such as the slower but more powerful cardiac contractions with a possible rise in arterial pressure and greater lateral tension of the chronically inflamed aorta.

What light is thrown on the problem of differential diagnosis by the discovery that there is in a given case a position of maximum pain?

1. If the problem presenting itself for decision is whether the pain is organic or functional in nature, the existence of a painful position is in favor of an organic lesion. Thus in cases of mediastinal new growth, including carcinoma of the œsophagus, aneurysm of the thoracic and abdominal aorta, gastric ulcer, etc., the nature of the attendant pain is not rarely misunderstood and is considered as being a functional manifestation of a neurosis. Under these conditions the demonstration that there is a distinct position of increased pain may be of decisive moment.

2. The presence of a painful position always indicates the advisability of a search for the organ or new growth causing it, and the location of the sensation attending the painful position will correspond to the situation of the organ or new growth in question. The detection of deeply situated tumors involving, for example, the pancreas or

œsophagus, is often a matter of difficulty and in these cases the presence of a painful position may be taken as confirming the results of the examination by palpation. Careful attention to this symptom may sometimes aid considerably in establishing an otherwise doubtful diagnosis.

In one case under my observation the occurrence of a painful position, together with glycosuria, seemed of significance. At the autopsy the symptoms were explained by the discovery of a carcinoma of the pancreas.

The occurrence of a painful position points toward a localized process, especially in dealing with the abdomen, even when the pain appears to be diffuse, as in appendicitis, intestinal cancer, cholelithiasis, nephrolithiasis, etc., and so may be of service in differentiating an ordinary intestinal colic from similar painful sensations originating in appendicular disease or localized malignant new growths.

The lateral posture is a painful position *par excellence,* for it involves the most favorable conditions for abnormal displacement and traction. The dorsal position (*e.g.,* retroperitoneal processes) or the sitting posture may also come into question, however. In the latter case the symptom is usually difficult to interpret. Pain in the small of the back and in the flanks is not infrequently caused after long sitting, especially if the body is inclined forward, by swollen abdominal organs like the kidney, spleen, liver, etc. These pains do not, however, appear very promptly, but only after long contin-

uance of the position, and the pain may sometimes also be explained as being the result of fatigue of the dorsal musculature.

THE INFLUENCE OF MOTION.

Under this heading only those forms of pain will be discussed that are modified in clearly recognizable fashion through bodily motion, either general or local. In these cases the pain may be produced or aggravated as if by carefully planned experimentation, and the differential diagnosis is facilitated by tests in this direction. A more or less superficial connection between pain and bodily motion in the sense that rest has a beneficial effect is very widespread and may, to some extent, be explained through the steadiness of the circulatory conditions (headache), and in the absence of mechanical insults (gastric ulcer) when the body is at rest. On the other hand, there is a group of painful sensations that appear on motion as the inevitable result of the general pain mechanism.

1. Disorders of the Organs of Motion.—These are maladies usually involving the extremities, which are accessible to careful and extensive physical examination so that special difficulties are not likely to be encountered. The greatest source of error is to be found in the fortunately comparatively rare diffuse diseases of the osseous system, such as osteo-

malacia and disseminated lesions of the bone-marrow. These possibilities must therefore always be kept in mind.

2. Disorders of the Circulatory Apparatus.—The intimate relationship existing between the vascular and muscular systems has as a result, that in disorders both of the central and peripheral portions of the circulatory system, motions may appear as a potent source of pain. The circulatory system is also one of the channels through which the physical and objective act of motion transforms itself into the subjective sensation of pain. Every muscle, whether it is striated or smooth, when in action makes increased demands on the vascular system as a whole, and also on its own peripheral district. In this way it is easy to understand on the one hand the possibility of the causation of local pain on locomotion in local disorders (crural, mesenteric, and coronary vessels), and on the other hand it is clear that muscular action may produce pain independently of peripheral demands through the indirect effect on the central portions of the circulatory system, as in aortitis, aneurysm, etc. It is therefore an easily explainable fact that all of the symptoms produced by aneurysm or chronic inflammation of the aortic walls, and especially pain, may be increased or brought about by bodily motion. If, for example, retrosternal or epigastric pain is caused

as the result of severe muscular exertion, such as climbing stairs, running, or battling against the wind, the possibility of the presence of disease of the circulatory system must always be suspected (atheroma of the thoracic and abdominal aorta, sclerosis of the coronary arteries, hepatic congestion). The same is true in regard to pain in the shoulder, or brachial neuralgia (aneurysm).

3. Abdominal Disorders.—In these there is not rarely an exquisite interdependence between pain and motion. This is especially true of acts that are accompanied by simultaneous exercise of the abdominal muscles, such as lifting weights, stooping, raising the head, defecation, backward or lateral inclination of the body, coughing, sneezing, etc. Undoubtedly it is the accompanying elevation of intra-abdominal pressure that gives rise to the painful paroxysms in already congested organs (ureteral and biliary colic, etc.), either directly or through the interference with the venous flow. Before the onset of typical attacks of pain and also after the subsidence of these the appearance of distinctly localized pain as the result of efforts of the sort just mentioned may direct attention to a local disorder in the nature of latent appendicitis or cholecystitis, etc. Pain in the neighborhood of the appendix, for example, is not rarely elicited during defecation, in drawing on the shoes, lifting the head, bending

the trunk to the left, on sitting down, etc. Pain in the epigastrium on bending the body backward would suggest the presence of an epigastric hernia.

The pain produced through forcible motion at the hip joint in inflammatory and suppurative processes in the neighborhood of the ileopsoas muscle involving the appendix, cæcum, kidney, and parametrium finds its explanation in the local pressure caused. Under these conditions it is important not to make the examination in the horizontal position, in which the abdominal muscles are relaxed, but to have the patient standing, as then the pressure effects are more pronounced. Of course it is also necessary to think of inflammatory processes involving the joint itself. The pain accompanying certain movements of the thigh in incarcerated hernia (obturator hernia) must not be overlooked in this connection. The jar communicated to the abdomen along the lower extremity on putting the foot to the ground may give rise to pain; for example, in the neighborhood of an inflamed appendix, a movable kidney, or in cholecystitis. This pain appears when the foot on the same side strikes the ground, and is more pronounced in walking down hill owing to the greater force of concussion.

Motion and any change of position is especially likely to give rise to pain in cases of acute suppurative peritonitis. The patient usually anxiously maintains the dorsal position and avoids turning to either

side. This point is of importance, for in certain other conditions that sometimes simulate peritonitis, such as intestinal ulceration and meteorism, hysteria, colic due to intestinal stenosis, etc., this symptom is conspicuous by its absence. In enteroptosis a careful study of the effect of position on pain is of value. Even extreme degrees of enteroptosis are sometimes unaccompanied by pain. In neuropathic, over-excitable persons, however, usually women, suffering from this condition, exertion may induce attacks of spasmodic pain that are difficult to distinguish from biliary or renal colic. Two points aid in the differential diagnosis: 1. The attacks are often promptly relieved on assuming the recumbent position. 2. The application of an abdominal binder is effective.

THE INFLUENCE OF PRESSURE.

The influence of pressure, especially pressure from within, is of great importance in the mechanism of spontaneous attacks of pain. An elevation of intracranial pressure gives rise to most severe headache. A rise of tension in the arterial system may produce extremely painful paroxysms; increase in the internal pressure in the liver, spleen, or kidney may cause acute pain through the tension of the capsule of the organ, and the same thing is true of localized distention in the gastro-intestinal canal.

Pressure from without exerted for the purpose of testing a painful condition is usually not effective

from all directions, as in the above instances, but only from a given point. Nevertheless, under some conditions spontaneous pressure effects in all directions may be experimentally imitated and made use of for differential diagnosis; for example, in dealing with the digestive tract. I remember one case in which the nature of a tumor below the left costal arch was in doubt until the colon was inflated. At once pain, localized strictly to the tumor region, appeared, and at the autopsy carcinoma of the splenic flexure of the colon was revealed. In a similar way in cases of carcinoma of the œsophagus with stenosis the administration of effervescent draughts may give rise to localized pain, evidently caused by the tension from within.

Pressure from Without.—When applied for diagnostic purposes this may be used in order to obtain more exact information in regard to the location of already existing pain, or it may be resorted to to discover a hitherto unrevealed area of hyperalgesia. This is especially true of the abdomen. In doing this it is well to remember that, even under physiological conditions and according to the degree of individual susceptibility, strong pressure may be more or less painful, and it is advisable always to compare similar areas on the two sides. It is further desirable always to outline the zones of hyperæsthesia to pressure as accurately as possible. The more deeply the pressure is carried the greater is the loss of the resulting pain in localizing value, and this is particularly true of the abdominal cavity.

Percussion.—By means of this it is possible to obtain an accurate estimate of the effect of pressure and this method of examination should never be omitted, especially in examining the abdomen. Positive results will generally be obtained by this procedure in dealing with organs that touch the abdominal wall with even only a portion of their surfaces, as the stomach, intestine, liver, and spleen in the anterior parts and the kidney in the posterior parts. The examination of the linea alba in this way for its whole length, from the xiphoid process to the symphysis, is especially to be recommended. If there is any diastasis of the recti, pressure or percussion in this region is not transmitted through the abdominal musculature, as is the case over the recti, but causes distinct manifestations of pain if one of the organic lesions in question is present.

In general it may be said that at every examination of the abdomen for purposes of rapid orientation it is wise to test the sensibility to pressure of the region of the pylorus and gall-bladder, the three flexures of the colon, the neighborhood of the appendix, and the hernial openings. Any local sensitiveness to pressure in the rectum or vagina should also be noted. The testing of local sensibility to pressure also forms a useful method of rapid orientation in cases in which accurate palpation is rendered impossible owing to tension of the abdominal walls as in ascites.

Among the pathological processes of a general nature that underlie pressure or percussion pain in

the abdominal region the first place must be given to peritoneal irritation, either circumscribed or diffuse. In addition, increase in the internal pressure also plays an important rôle; for example, in such conditions as hepatic congestion, and circumscribed or diffuse gastro-intestinal distention, especially when accompanied by ulcerative or peritonitic lesions. Thus the hyperæsthesia of the congested liver diminishes in proportion to its decrease in size, and the tenderness of gastric ulcer may decrease from an excessive degree to a very slight amount within a few hours owing to the subsidence of gastric distention. The sensitiveness of an inflamed appendix may in the same way diminish suddenly on the expulsion of fæces and gas. While in most cases it is natural to associate any existing abdominal tenderness with the topographically related organs the rarer possibilities must also be kept in mind. For example, the symptom may have its seat in the abdominal musculature itself, as in the epigastric tenderness due to fatigue of the origins of the recti following persistent attacks of coughing. If the seat of the pain is situated behind the muscle the contraction of the latter usually diminishes or abolishes the effect of the pressure, and this may be of value in differential diagnosis. The vascular system of the abdominal cavity, particularly the aorta, may also be the seat of tenderness in the epigastrium. Furthermore, the possibility of neuralgic tenderness of the sensory tracts should not be forgotten, as in lead colic, gastric crises, etc. Sometimes in abdom-

inal neuralgias of this sort intense pressure, over the epigastrium for example, may seem to have the effect of relieving pain. This sign may sometimes be made use of in diagnosis, though caution is necessary, as the same thing exceptionally occurs in organic diseases.

I am inclined to consider the accurate localization of tenderness of the sympathetic nerve fibres and plexuses running deep down along the spinal column as theoretically highly desirable but practically impossible, and the same thing may be said in regard to the determination of tenderness of the solar plexus.

THE INFLUENCE OF FOOD.

While the importance of the exact determination of the alimentary causation or modification of pain phenomena is very great, the difficulties attending the demonstration of a relationship of this sort are no less so. This is especially the case when the evidence consists only of the biased or inaccurate observations of the patient himself. Frequently the connection between the two events is denied with the statement that pain is present also when food is not being taken and that the composition of the ingesta has no noticeable effect. It is evident that both of these conclusions are erroneous. In the first instance, it is permissible to draw only the inference that the ingestion of food is not the only pain-producing factor, and in the second that the quality of the food is of slight importance. The difficulty of estab-

lishing a relationship of cause and effect is also increased through the fact that in most cases the pain, at least as far as it involves the gastro-intestinal tract, appears only several hours after the ingestion of food.

If the pain begins during the taking of the food itself a deep-seated stenosis of the œsophagus, particularly carcinomatous, should be thought of even in the absence of well-defined dysphagia and though the pain be localized in the epigastrium. The painful sensations caused by the food masses that become impacted above the stenosis are not infrequently referred to the epigastrium, are accompanied by a feeling of pressure, and usually disappear suddenly at the moment that the bolus passes the obstruction. Alimentary modification of the pain is ordinarily to be taken for granted only when the pain follows the ingestion of food with great regularity and after the lapse of a uniform interval of time. In these cases it is always advisable to determine the relationship experimentally by modifications in the amount and composition of the food.

The ingestion of food may serve to produce pain in several ways, among which the most important are as follows:

1. The increase in gastro-intestinal peristalsis following the taking of food may serve mechanically to induce pain. In this connection the effect of cold appears to be especially noteworthy, as when cold water is taken. The colicky pain sometimes appearing in acute enteritis or appendicitis a short time

after a drink of cold milk, for example, is certainly caused in this way. When inflammatory ulceration exists in the œsophagus, pylorus, intestine, etc., it is natural to assume that the muscular contractions set in motion for the purpose of carrying along the contents of the viscus form the cause of the pain, so that it is easy to understand that the composition of the food itself may not be of any particular importance.

2. Chemical stimuli in the form of ingested acids, spices, etc. The decomposition products resulting from bacterial action on carbohydrates and fats must also be included under this head.

3. Local irritation due to the mechanical action of substances like hard bits of meat and similar bodies, distention of the gastro-intestinal wall through the formation of gas due to the fermentation of farinaceous foods, fruits, etc. This mode of causation seems to play an especially important rôle in cases of gastro-intestinal ulceration.

The factors mentioned above have a positive action; that is to say, cause increase in pain, but there is also the possibility of an influence in the opposite direction. It is a fact that not only in gastric neuroses but also in cases of ulcer and sometimes in gastric carcinoma the ingestion of food may alleviate or entirely relieve previously existing pain. Two possibilities must be considered in this connection: 1. The excessive and painful peristalsis is relieved by the entrance of food into the stomach (the growling of a hungry stomach). In cases in

which the nature of the food seems to be unimportant, so that even a piece of bread, for example, has an anodyne effect, this appears to be the most natural explanation. 2. The food consumed, such as milk, for example, combines with acid after the fashion of an alkali.

In regard to the time of appearance of alimentary pain phenomena the variability of the causes explains the differences observed in the period of their appearance, although in the same individual the time intervals in cases of organic disease are often very uniform. The painful attacks attending lesions of the pylorus, for example benign stenosis, appear with great regularity two or three hours after the midday meal, probably in connection with the expulsive period of digestion. Cases are observed often enough, however, in which the interval is as much as five or six hours. I consider that attempts to draw inferences from such observations regarding the position of the lesion, for example, that it is a duodenal ulcer, are entirely unwarranted. On the one hand the appearance of the pain of pyloric ulcer may be much delayed as has been mentioned, and on the other, in duodenal ulcer and intestinal affections including those of the colon (cancer of the sigmoid flexure, appendicitis, etc.), the pain may be felt a very short time after the food has been taken. It is interesting that in some cases of pyloric ulcer the onset of the pain is delayed if the quantity of food taken is very large. This is probably due to the fact that the expulsion of the gastric contents

is retarded. When there is a clearly demonstrable connection between the ingestion of food and the pain, internal gastro-intestinal lesions, especially those of an ulcerative and stenotic character, must be thought of. In addition, the somewhat rarer perigastritic processes should be kept in mind, such as adhesions between stomach and liver in syphilis of the latter organ, adhesions between stomach and colon in carcinoma of the splenic flexure, etc. Enlargement of the organs in the neighborhood of the stomach must also be considered, such as echinococcus of the liver or spleen, pancreatic cysts, etc., but these lesions are more apt to be accompanied by a sensation of uncomfortable pressure rather than by direct pain.

Organic lesions are particularly likely to be present in cases in which there are no fluctuations in the intensity of the symptoms, in which the effect of psychical factors is slight or entirely absent, and the alimentary factor is characterized by great consistency. Owing to the close interrelationship between the gastro-intestinal tract and the large abdominal glands, the liver and pancreas, it is natural to expect *a priori* that on account of the circulatory changes in these organs attending the digestive act pain from these districts also should be subject to alimentary modification. Such interdependence is very irregular in its manifestation, however, and frequently cannot with certainty be demonstrated at all. Equally irregular is the alimentary relationship of the pain often observed after the subsidence

of lead colic or gastric crises. In the former condition painful attacks are not rarely the result of a diet that tends to gas formation.

Pain resulting from disease of the circulatory system is also susceptible of modification by the ingestion of food, as will appear later. Attacks of angina pectoris may follow meals excessive in amount or composed of food causing gastric and intestinal distention. The phenomenon may probably be explained in part by the rise in blood pressure and increased demand upon the heart. The influence of food ingestion may also be observed in cases of atheroma involving the gastro-intestinal vessels.

"Rheumatic" pain (gout and allied diatheses) appears sometimes to be increased by the consumption of dark or underdone meat.

THE INFLUENCE OF DRUGS AND CHEMICALS.

All forms of pain exhibit a wide-spread susceptibility to modification by the administration of drugs, quite independently of the effects of the narcotics. Furthermore, there may be in some cases a specific susceptibility obviously depending on more or less fundamental factors in the mechanism of production of the pain in question, and which may be made use of for the purposes of differential diagnosis. It is well known with what regularity the paroxysms of angina pectoris respond to the administration of the vasodilators. For this purpose I should especially recommend erythrol tetranitrate given in tablet form

in doses of from 0.01 g. to 0.03 g. In a case presenting indefinite pain in the neighborhood of the heart or in the epigastrium and where there are other reasons for suspecting vascular disease, the resort to an erythrol tetranitrate test may be of great diagnostic value, especially if the effect is more or less sudden and the same result always follows a repetition of the test. Obscure neuralgic pains in the left upper extremity may also be unmasked in this way and be found to depend on an irregular form of angina. Reflex pain of this sort in the arm is sometimes relieved by cold to the precordium.

Local anæsthetics may be used for the purposes of differential diagnosis in order to determine whether the cause of the pain is peripheral or central. The subcutaneous injection of cocaine has been recommended for this purpose in trigeminal neuralgia and a 5 per cent. ointment of morphine has been used with a similar object. In testing the gastric mucosa the use of anæsthesin in 0.5 g. doses, or of cocaine (about 16 drops of a 1 per cent. solution), may be recommended. The pain of gastric ulcer or of ulcerating carcinoma of the œsophagus usually ceases within about a quarter of an hour after the administration of these amounts of anæsthesin or cocaine. If this occurs in a case under consideration, duodenal ulcer is improbable, and I therefore suggest this anæsthesin test as a means of differential diagnosis between gastric and duodenal ulceration. A prompt result following the anæsthesin treatment in cases of epigastralgia usually

indicates a lesion of the gastric mucosa such as ulcer or carcinoma and justifies the assumption of a local causation of the pain. If the pain is accompanied by evidences of stenosis, such as increased gastric peristalsis or dysphagia, a positive result of the test would point to internal stenosis with changes in the mucous membrane.

In order to decide the question whether a gastric pain is partly or entirely caused by hyperæsthesia to hydrochloric acid this may be given while fasting in doses of 1–5 drops of the dilute acid to a tablespoonful of water. The administration of alkalies such as sodium bicarbonate forms the counterpart to this test. It must be borne in mind, however, that sodium bicarbonate may bring relief and cessation of pain by causing the stomach to expel any gas that may be present. Furthermore, an anodyne effect of alkalies does not necessarily indicate hyperacidity—the amount of acid may even be quite small and the patient be suffering from hydrochloric hyperæsthesia. Epigastric tenderness due to hepatic congestion is usually very amenable to digitalis treatment. If it shows a tendency to increase while the other evidences of congestion subside the complication of gastric ulcer must be suspected (ulcer in a congested stomach).

The rapid relief of headache or neuralgic pain by the administration of iodine and mercury of course suggests syphilis. In cases of headache, trigeminal neuralgia, sciatica, etc., accompanied by constipation, it is advisable to resort to purgation in

endeavoring to obtain insight into the etiology of the pain. While the intestinal condition is not very frequently the sole cause of the pain, there is no doubt that it sometimes is an important factor, and the diagnostic and therapeutic aims may be united. In gastric ulcer, the colic of pyloric stenosis, lead colic, etc., an important rôle in the pain formation is often played by stagnation of the fecal masses. Paroxysms of abdominal pain of the most varied nature (gall passages, ureters, etc.) frequently respond very directly to the cautious evacuation of the intestine either through cathartics given by mouth or through the rectum.

The hypodermic injection of distilled water may be of diagnostic value in obscure pain, especially in cases in which the patient's suffering is completely or in part the result of autosuggestion. Even if the pain diminishes there is always the possibility that in addition to the functional element there is also an organic causative factor, and in this way it is possible to form an idea of the intensity of the latter. Obscure pain about the thorax (shoulder, interscapular space, etc.) which is increased by the injection of tuberculin probably is related to an underlying tuberculous process.

THE INFLUENCE OF ORGANIC FUNCTION.

The coincidence of certain pain phenomena with one or another organic function may form the starting point of a diagnostic analysis. Sometimes such a conjunction may afford appreciable assistance, but

it must be confessed that often there is danger of its leading into error.

Defecation.—The act of defecation, for example, may exhibit the most varied relationships to pain phenomena of widely differing origin. Coprostasis of long duration causes stagnation and abnormal decomposition in the entire digestive tract, including the stomach, and it is not surprising, therefore, that the pain accompanying many gastro-intestinal conditions, such as appendicitis, intestinal stenosis, lead poisoning, ulcer, stenosis of the pylorus, etc., may be favorably affected by the cautious production of an evacuation, a fact which deserves careful consideration from the standpoint of therapeutics also. In dealing with inflammatory lesions in the abdomen care must be taken, however, that the act of defecation does not involve too great a degree of exertion of the abdominal musculature. Otherwise precisely during the act of defecation strictly localized pain may be caused corresponding to the position of the inflamed appendix or diseased gall-bladder, or in the neighborhood of a carcinoma of the colon or gastric ulcer. Such an occurrence may have diagnostic value in determining the position of the process in question. This localized pain, accompanying abdominal straining, may be spoken of by the patient and be of assistance in the diagnosis in cases of quiescent appendicitis, or on the other hand, in the early stages of the disease. Backache resulting from gastro-intestinal distention (intestinal stenosis, etc.) is usually perceptibly relieved

after a movement of the bowels. If the movement is regularly preceded by pain immediately before the act, deep-seated ulcerative processes such as carcinoma of the rectum should be suspected.

In cases of latent angina pectoris severe abdominal straining during defecation may cause the onset of a paroxysm, or slight retrosternal premonitory sensations may be induced. The favorable effect of defecation is often indubitable and even astonishing in many cases of headache, especially, it appears to me, in those types which are accompanied by an elevation of intracranial pressure. A laxative frequently is much more effective than are antineuralgics, even in cases of severe organic lesions like brain tumors. In these cases the improvement must depend on alterations in the intracranial circulation, for the effect is often very sudden. Meteorism may lead to stasis in the superior vena cava and in the cerebral veins through the restriction of the respiratory venous aspiration, and the important part played by normal intestinal peristalsis in facilitating the venous circulation in the portal district must also be considered. In these cases, too, the act of defecation may give rise to temporary increase in the headache if it is accompanied by undue straining efforts.

The onset of gastric crises in tabes not rarely occurs in conjunction with defecation and the evacuation of fluid stools. It is likely, however, that the act of defecation is in these cases only indirectly to be associated with the gastric symptoms (increased

gastro-intestinal peristalsis). The phenomenon is of interest, however, as attacks of colic of other sorts are usually attended by obstinate constipation. In enteroptosis, intestinal atony and neuropathic conditions persistent constipation sometimes appears rather to have the effect of deferring the onset of functional pains, such as gastralgias.

Vomiting.—If vomiting accompanies abdominal pain the coincidence of the latter with this common symptom is more apt to lead astray than to be of direct diagnostic service, unless it happens that the nature of the vomitus (blood, sarcinæ, lactic acid bacilli, hyperchlorhydria, etc.) gives the necessary clue. One may easily be deceived by the vomiting in chronic intestinal stenoses, for example in tuberculous ulceration of the small intestine, and in the absence of peristaltic movement be led to assume a gastric lesion such as stenosis of the pylorus as the starting point of the pain. Slight alleviation of the pain after vomiting is sometimes observed in painful seizures of the most varied nature, such as angina pectoris, renal infarct, cholelithiasis, etc. Prompt and often complete relief to the pain is particularly characteristic of attacks of colic due to stenosis of the pylorus.

Deglutition.—Pain accompanying the act of swallowing may depend on internal or external causes. If the source of the sensation is in the upper part of the œsophagus its detection will ordinarily not prove difficult. If the patient has fever the possible existence of laryngeal tuberculosis should

not be forgotten. If the dysphagia is due to ulceration of some portion of the œsophageal mucosa an increase in the pain is usually caused on taking acids or spiced articles of food. On the other hand, the administration of local anæsthetics like anæsthesin will prove beneficial. This effect of food or drugs is generally absent if there are other causes for the disturbance in deglutition, unless secondary ulcerations have been caused. The deglutition pain of aneurysm frequently radiates into the left shoulder or below the clavicle.

Menstruation.—While it is natural to refer to the genital apparatus pains occurring together with menstruation—or at least, if they involve regions at a distance such as headache or gastralgia, to associate them with this function—it must always be borne in mind that the menstrual process leads to increased irritability of the system in general. Therefore, whenever there is already present an irritative condition, such as cholelithiasis, appendicular disease, ulcer of the stomach, etc., attacks of pain may be brought on in these regions of lessened resistance. This is especially true of the appendix, owing to its topographical relationships and its circulatory connections. In distinction to this many obstinate abdominal pains such as gastralgias seem to be checked during pregnancy. This is particularly the case in enteroptosis, probably in part owing to the diminution of the abnormal mobility of the abdominal organs. Menstruation sometimes acts in a similar way.

Respiration.—In dealing with shoulder pains induced by respiration, it is always advisable to think of the possible presence of apical tuberculosis with secondary perineuritis of the brachial plexus (tenderness on pressure). Thoracic pain may of course be purely myogenic in nature in spite of its dependence on the respiratory act. Pleural pain is likely to be axillary in location. The retrosternal pain sometimes produced by deep respiration in cases of atheroma of the aorta may be explained by the traction on the vessel. Both local and diffuse peritonitic lesions such as perihepatitis, perigastritis, etc., as well as lesions of movable abdominal viscera in general, are frequently the seat of pain on the inspiratory descent of the diaphragm in deep breathing. In appendicitis the pain caused by deep inspiration is sometimes more significant than local tenderness.

CHAPTER III.

Topography in its Relation to Pain.

While in external diseases the site of pain nearly always corresponds to the lesion, this is true of internal affections only with certain reservations and in this connection there is found an unending source of diagnostic errors. Even the general question of whether the presence of local pain indicates the existence of any disease of an internal organ and is not due to an external lesion, may sometimes be difficult to answer. Before arriving at the conclusion that a certain painful sensation is caused by internal disease, it will be found practically useful to exclude the possibility of an affection of the organs of motion—joints, muscles, or bones—as well as of disorders of the nervous system (*v.* Neuralgias). The patient's own sensations and his description of the pain as being deep seated may sometimes, but not always, point to the existence of an internal lesion.

The following discussion of pain in connection with topography will be devoted only to those manifestations that are the result of disease of the internal organs. The inclusion of disorders of the organs of motion and of the nervous system would lead too far afield. Even with this restriction, however, completeness of exposition is out of the question and therefore only certain districts of the body

will be considered, which may be regarded as nodal points for painful sensations emanating from different directions. The obvious will be omitted and only more unusual and easily overlooked phenomena will be discussed, particularly from the therapeutic standpoint. For the purposes of practical differential diagnosis it will not do to hold too closely to purely topographical considerations. It is especially desirable to study the factors that influence the pain; that is to say, the examination must include a test of function as well as of the accompanying symptoms, as has already been pointed out in detail in the section on the analysis of pain. In the following pages I will be as brief as possible, as a more detailed discussion of the various organic pains may be found in the chapters devoted to each of these.

I. THE SHOULDER.

The internal organs coming in question under this head are as follows:

a. *Lung.*—Affections of the pulmonary apices, especially tuberculosis and new growths, not infrequently cause spontaneous shoulder pain as well as tenderness of the brachial plexus, probably through the development of perineuritis or direct involvement of the branches of the plexus. I have found that tenderness is particularly apt to occur at the junction of the outer and middle thirds of the upper border of the trapezius. When pain in the shoulder is complained of by persons of tuberculous appearance this possibility should be kept in mind.

b. *Thoracic Aorta.*—Aneurysm and atheroma of the thoracic aorta not infrequently are accompanied from the very first by persistent shoulder pain. This may be either bilateral or only on one side. In addition to spontaneous pain there is frequently also tenderness over the brachial plexus as well as in the upper intercostal spaces in front. Of great diagnostic importance is the fact that the pain is increased by exertion, such as stair climbing, etc., as well as its coincidence with increased heart action. Quieting cardiac activity by bodily rest and the application of cold compresses generally relieves this aortic shoulder pain. Motion at the shoulder joint may be free and painless, but lifting the upper arm from the side above the horizontal line is likely to evoke pain (traction on the subclavian artery?). It must be remembered that, especially in atheromatous disease of the subclavian artery and in cases of the arthritic diathesis, aneurysm of the aorta and chronic aortitis may coexist with more or less independent disease of the shoulder joint (rheumatic joint lesions).

c. *Subdiaphragmatic Organs.* — Inflammatory processes occurring in the liver, spleen, or stomach, or in their subphrenic surroundings. Shoulder pains transmitted in this way through the phrenic nerve of the same side usually do not attain particular intensity. The causative lesion, such as echinococcus of the liver, subphrenic suppuration, perisplenitis in leukæmic spleens, perigastritis in ulcer of the stomach, etc., ordinarily causes much more

acute local symptoms, so that if the possibility of this connection is kept in mind the danger of misinterpreting the shoulder pain is not very great. The shoulder pain may sometimes be latent and appear only on pressure on the brachial plexus or on the above-mentioned pressure point at the upper edge of the trapezius.

II. RETROSTERNAL REGION.

a. *Circulatory Apparatus.*—The pain accompanying such affections as aortic aneurysm, chronic aortitis, and sclerosis of the coronary arteries, which are the ones most often concerned under this heading, is accompanied by a pronounced sense of constriction, and has the further peculiarity of being promptly influenced and increased on exertion such as running, climbing stairs, etc. The very intense retrosternal pain that is sometimes seen in cases of pericarditis is not paroxysmal but is persistent.

b. *Mediastinum.*—Bifurcation of the trachea and local affections of the mediastinum. The retrosternal pain often accompanying the cough in acute bronchitis is usually to be explained by the inflammatory condition at the bifurcation of the trachea. In some cases similar changes in the neighboring lymph glands may contribute to its causation. The more or less severe and persistent retrosternal pain not rarely accompanying severe dyspnœa of long duration may have a similar origin, and I have found this symptom a not infrequent accompaniment in cases of miliary tuberculosis. Mediastinal new

growths, such as lymphosarcoma, etc., also not infrequently cause retrosternal pain that may be relieved to some extent by leaning forward. Such pain may be increased by rapid walking, etc., probably through the forced inspiration and consequent increase in the motility of the trachea and traction on the surrounding structures. This observation may lead to the erroneous diagnosis of angina pectoris.

c. *Œsophagus, Stomach, and Liver.*—Fairly severe retrosternal pain may be due to stretching of the wall of the œsophagus on taking food if the lower portion of the tube is stenosed. Pain of this nature exhibits marked dependence on alimentary conditions. There may also be persistent sternal pain, possibly modified by changes in position and accompanied by tenderness of the sternum and of the spine or of the left dorsal region. Retrosternal radiation of the pain is not rare in ulcer of the stomach and pyloric stenosis, although in these conditions the pain is rarely found only in this situation. The same thing is true of hepatic affections.

In the preceding, retrosternal sensations have been considered only in so far as they reach the point of actual pain. Sensations such as the feeling of oppression sometimes occurring in nervous asthma, tuberculosis, dilatation of the right heart, or tabes, are not within the limits of the discussion.

III. THE SCAPULA AND INTERSCAPULAR REGION.

More than in any other part of the body pain in this district suggests the possibility of disease of the organs of motion (spinal column, dorsal muscles)

as well as neuralgia. Only after these have been excluded or on the demonstration of corresponding organic lesions is it justifiable to consider the latter as being responsible for the pain. In general the possibilities are the same as those relating to shoulder pains, and here also pulmonary affections like tuberculosis are not unimportant. Sometimes chronic inflammatory changes in the pleura leading to the formation of adhesions or glandular changes, acting like the retroperitoneal glands in causing backache, may manifest themselves subjectively by interscapular pain. Secondary neuralgic conditions of the intercostal nerves must also be thought of; at any rate pains of this sort always indicate an exhaustive examination of the lung.

Aortic lesions (aneurysm, chronic aortitis) also not rarely give rise to pain in the interscapular region, especially on the left side. Frequently there is also a feeling of painful pressure and sometimes a dependence on particular positions of the body. Exertion naturally often increases such pain. The intimate relationship of the liver and gall-bladder, spleen, and stomach to the shoulder blade of the same side is well known, and reference may be made to what has been said above.

Of gastric disorders it is particularly stenosis of the pylorus that gives rise to painful attacks with radiation into the left, or more frequently, both shoulder blades. This radiation of the pain seems to some extent to run parallel with the intensity of the distention of the stomach during the paroxysm.

The shoulder pains previously described represent a spatial prolongation of the radiation which ordinarily rarely passes upward beyond the spine of the scapula. It may also be mentioned that the radiation of headache into the interscapular space is generally associated with an increase in intracranial pressure, as in brain tumor, meningitis, etc.

IV. THE EPIGASTRIUM.

The series of organic lesions manifesting themselves through pain in the epigastrium is so great that from the standpoint of practical differential diagnosis it seems more suitable in each case to abandon promptly the purely topographical factor and to turn the attention to certain characteristic features of each type of epigastralgia, such as those comprised in the modifying factors, accompanying manifestations, etc. In this way more rapid orientation is possible and the diagnostic possibilities may rapidly be narrowed. Here again, as was pointed out at the beginning of the chapter, lesions of the organs of motion, such as the muscular pain following persistent cough, muscular hæmatoma, etc., and diseases directly concerning the nervous system, like the neuralgia of spondylitis, the girdle pains of tabes, or gastric crises, will not be discussed at length.

The most important differential points to be discussed are as follows:

a. *Tenderness to Pressure and Percussion.*—It is true that most of the spontaneous pains in this dis-

trict are accompanied by tenderness to pressure, but the exact localization of this, and particularly the determination of the point of maximum tenderness, may be of importance. This is true, for example, for the tender gall-bladder in cholelithiasis, pain on pressure under the left costal arch in gastric ulcer or carcinoma, or in syphilis of the left lobe of the liver, sharply circumscribed tenderness in ulcer and epigastric hernia, the relation of the sensitive point to the edge of the liver, and so on. The absence of tenderness in spontaneous attacks of pain would suggest, though not without reservation, the diagnosis of gastric crises, essential gastralgia, or lead colic. Its presence, however, is not sufficient to exclude the latter affection.

b. *Colic.*—In addition to the common paroxysms of biliary colic and gastralgia, such conditions as intestinal stenosis, new growths of the small intestine, tuberculous intestinal ulceration, etc.—as well as particularly appendicular disease, pancreatic colic, and angina pectoris—must also be considered.

c. *Collapse.*—The evidences of collapse may appear at the acme of any attack of colic, but such severe general symptoms are especially suggestive of perforation, as in gastric or duodenal ulcer, acute intestinal obstruction, gastric crises, pancreatic necrosis, and angina pectoris.

d. *Causation through the Ingestion of Food.*—Under this heading may be included gastro-intestinal lesions, processes in the neighborhood of the stomach accompanied by progressive increase in

size, such as echinococcus of the liver, splenic tumor, deep-seated stenoses of the œsophagus, and more rarely, angina pectoris and cases of painful intermittent dilatation of the abdominal aorta.

e. *Causation through Exertion.*—In this class may be grouped diseases of the circulatory apparatus, like sclerosis of the coronary arteries and chronic aortitis. The sensation of painful pressure due to hepatic congestion of course is also considerably increased on motion.

f. *Position.*—The existence of a position of maximum pain (*v.* p. 24) generally may be taken as indicating an organic origin for the symptom.

g. *The Influence of Drugs* (*v.* p. 41).—This concerns particularly the internal administration of local anæsthetics, of hydrochloric acid and alkalies, as well as of erythrol tetranitrate.

h. *Vomiting and Regurgitation.*—Whenever pain is due wholly or in part to distention of the stomach walls by stagnating fluids or by gas relief is afforded when the contents are ejected. This is particularly the case in pyloric stenosis. Primary gastralgias are sometimes relieved by the belching of gas and thus show themselves to be not entirely of functional character. It goes without saying that the vomitus should be carefully examined.

Of much more importance than localization in the epigastrium is asymmetrical distribution of the pain. If this is more manifest on the right or the left,

either spontaneously or on pressure, an organic condition is *a priori* more likely. One must be sure, however, that one is not dealing with an individual presenting general unilateral hyperæsthesia as in hysteria. Tenderness just below the costal borders may easily be misinterpreted since it may be caused by processes actually in some other region. Pleurisy and pneumonia must always be thought of, and pelvic processes may also come in question.

A. *Localization on the Right Side.*—Below the right costal arch: Spontaneous pain and tenderness in disease of the gall-bladder, of the pylorus, the duodenum (ulcer!), the hepatic flexure of the colon, as in carcinoma or flatulence, renal infarct, etc. In appendicular disease the tenderness is usually lower down; in pleurisy and pneumonia of the lower lobe there is usually only tenderness.

B. *Localization on the Left Side.*—Below the left costal arch: Here both in spontaneous pain as well as in tenderness to pressure ulcerative conditions in the stomach should always be thought of first, particularly as occurring in the middle region of the organ, although gastric crises sometimes, even if rarely, are distinctly left-sided. Furthermore, intestinal carcinoma, particularly of the descending colon (radiating to the anus), should be thought of. When there is a tendency to flatulence pain in this region is also not uncommon. Lesions of the pancreas (cysts), affections of the spleen, and painful cardiac conditions (angina pectoris) must also be considered.

V. THE ABDOMEN BELOW THE UMBILICUS.

In order to avoid error, it should always be taken into account that in cases of enteroptosis organs situated in the upper part of the abdomen, such as the kidney, stomach, or gall-bladder with a corset liver, may give rise to pain in the lower abdomen. On the other hand, viscera originally situated in the pelvis may in some conditions develop upwards (urinary bladder, ovarian cysts, extrauterine pregnancy, etc.). If the patient is a woman and there is tenderness over the lower part of the abdomen extending to either side the possibility of some pelvic process must be taken into account. A bimanual vaginal examination is then necessary in order to determine the condition of the uterus, tubes, and ovaries, exudate in the cul-de-sac of Douglas, etc. The neighboring hernial openings are also to be investigated and rectal examination should not be omitted. Pain on the left side suggests the various affections of the sigmoid flexure, including carcinoma, dysentery, membranous enteritis, volvulus, foreign bodies introduced through the anus, etc. In chronic constipation the region of the sigmoid flexure is frequently painful or tender on pressure, and relief follows an evacuation of the bowels. If on the right side, attention is directed to lesions in the neighborhood of the cæcum and the appendix, including tuberculous glands or ulcerations, intestinal perforation in typhoid fever, distention of the cæcum in atony of the colon, etc.

VI. THE LUMBAR REGION (SYMMETRICAL).

Symmetrical lumbar pain is but little adapted to furnish decisive diagnostic information. After excluding lesions of the musculature or fascia, such as lumbago and diseases of the spine, like spondylitis, osteomalacia, etc., there is a wide range of possibilities in which nearly all the abdominal organs compete, including particularly the female generative system. The demonstration of alimentary modification of the backache is of importance since it occurs in ulcerative processes of the stomach or large intestine. In these as well as in disorders of the colon, for example carcinoma, the pain often apears within even a few minutes after the ingestion of cold fluids or solid food. This phenomenon is probably to be interpreted as the result of a reflex stimulation of intestinal peristalsis. Accumulations of gas above stenoses appear to be particularly prone to induce backache. In gastric ulcer with distention of the stomach, in pyloric stenosis, and in carcinoma of the colon backache is sometimes observed which disappears promptly when the stomach or intestine empties itself, thus showing its dependence on the distention of these organs. Very deep-seated carcinomas frequently lead to pain in the neighborhood of the sacrum, and the same may be said of hemorrhoidal conditions. Backache occurring during pregnancy and which is particularly severe on walking is of great practical significance, as it is a symptom of osteomalacia. A dependence on motion, particu-

larly stooping, is also often present in backache not originating in the apparatus of motion itself, as in hepatic, splenic, and renal processes, new growths of the colon, etc. The backache sometimes complained of in leukæmic swelling of the spleen, or other enlargements of abdominal organs, is manifestly due to the compression of the swollen viscus caused by the position. Persons with pendulous abdomens find that their backache is promptly relieved by manual support of the abdomen, and thus suggest the applicability of an abdominal binder.

The dorsal position is particularly likely to be painful in cases of retroperitoneal tumor formation through enlarged glands, aneurysm, pancreatic cysts, etc., and it seems reasonable to explain this on the ground of the increase in compression accompanying this position. A rather rare condition that I have observed is backache occurring in chronic lead poisoning. This is sometimes accompanied by radiation into both thighs and is followed by colicky pain in the neighborhood of the umbilicus.

Very severe backache together with a doubtful skin eruption suggests the possibility of smallpox, and this symptom is also associated with many other infectious diseases like typhoid fever and meningitis. The following case is of interest in this connection.

After exposure to cold a man of twenty-five years suddenly, on December 27, 1907, developed severe backache, and pain in the interscapular region. The pain was increased by motion and disappeared when at rest. The next day the pain also involved the lower extremities, which became stiff, so that a cane was needed in walking. On the 31st the back was so stiff that the patient could

not sit up; there were frequent lightning-like tetanic convulsions and spasm of the masseters.

In this case of "rheumatic" tetanus, which ended in recovery, the backache was the first symptom.

VII. THE LUMBAR REGION (UNILATERAL) AND THE FLANKS.

The presence of spontaneous pain or tenderness in the right or left lumbar region or in the flank has much greater diagnostic value and restricts the possibilities much more than backache that is symmetrical. Frequently there is no spontaneous pain, but it is necessary to test for tenderness by pressure, or preferably by light blows with the ulnar side of the clenched fist. Under these conditions painful renal affections must always be thought of, particularly if the corresponding flank is also tender. Furthermore, on the right side: Appendicitis with retrocæcal abscess, hepatalgia, and especially cholelithiasis. On the left side: Gastric ulcer, perisplenitis, and pancreatic lesions. It must not be forgotten that new growths or inflammatory processes of the parametrium may give rise to tenderness in the flanks.

ATYPICAL ABDOMINAL PAINS.

While the limits comprised under such a heading as this are necessarily arbitrary, its introduction is justifiable from the practical standpoint. For various reasons abdominal pains not rarely offer unusual difficulties in diagnosis. Frequently it does not suffice simply to observe and to correlate the observa-

tions to form diagnostic conclusions, but it is necessary to go further and consider even the rarer possibilities. The processes that most often lead to diagnostic errors may perhaps be classified in the following way:

1. *Atypical Attacks of Colic and Thoracic Processes.*—The source of the pain is found in a more or less characteristic and anatomically sharply circumscribed organic lesion, but the attacks of pain are rudimentary or there is an absence of localizing symptoms pointing to the organ in question. It is well known, for example, that appendicular disease or lesions of the gall-bladder frequently manifest themselves by pain in the middle of the epigastrium, and that biliary and ureteral colic and the pain of pancreatic disease may appear in paroxysms embracing a wide area. Wrong diagnoses are to be avoided only by the most careful search for a point of maximum tenderness, such as the testicle, gall-bladder, etc., and possible attendant symptoms such as dysuria, glycosuria, urobilinuria, etc. In this connection those cases should also be considered in which the source of the abdominal pain is found outside of the abdomen, like the epigastric pain of chronic thoracic aortitis or disease of the coronary arteries and the tenderness under the costal arch and in the flank in cases of pleuropneumonic disease of the same side, etc.

Lesions of the œsophagus, especially deep seated, malignant growths, not infrequently cause epigastric pain. This is also true of the very rare cases of

spontaneous rupture of this structure which sometimes occur in heavy drinkers while vomiting, the patients going into deep collapse. It is less well known that bleeding from œsophageal varices may lead to intense abdominal pain.

R. B., an official, aged thirty-six years, in August, 1900, began to complain of flatulence, diarrhœa, and loss of appetite. On the 13th of the month moderate enlargement of the abdomen was noted for the first time. Alcoholism was admitted. On August 26, after drinking some milk there was suddenly exceedingly severe pain in the epigastrium, and hæmatemesis (about ⅛ litre of blood). There was a feeling of great tension in the abdomen, especially on the left side of the epigastrium. Pressure in this region gave relief; the pain radiated into the back. The eructation of gas gave some relief. The subcutaneous injection of 0.03 of morphine was without effect. The epigastrium was very prominent, fluid could be demonstrated in the abdomen, and the patient went into collapse with jactitation. Death followed at two o'clock on the same day. At the autopsy cirrhosis of the liver was found, with perforation of an œsophageal varix. The stomach and intestines were filled with blood-clots.

In a similar way bleeding from a gastric ulcer may lead to sudden diffuse abdominal pain.

2. *Cystic New Growths and Foreign Bodies in the Intestine.*—Under this heading cyst formations, such as those of the mesentery, pancreas, and ovaries, must be considered. As will be pointed out in describing pancreatic pain the sensations attending these are not susceptible of uniform interpretation. For example, mesenteric cysts may on occasion give rise to pain through the obstruction caused to the passage of gastric and intestinal contents (direct stenosis, volvulus?), or they may give rise to second-

ary neuralgia (solar plexus). The latter possibility enters particularly into the question of pancreatic cysts. The obstruction of venous trunks through the torsion of the pedicle may lead to a rapid increase in pressure in the interior of the cysts and therefore give rise to pain through the augmented tension of the cyst wall.

Pathological processes in the abdominal lymph glands, both mesenteric and retroperitoneal, must be thought of in cases of obscure spontaneous attacks of pain as well as when tenderness to pressure exists (typhoid, tuberculosis, neoplastic mesenteric glands, etc.). Swollen glands, for example in leukæmia, are particularly likely through compression of neighboring nerve centers, such as the solar plexus, to cause neuralgias of the severest type and resembling attacks of colic. In this group may be included also the pain accompanying the course or termination of a tubal pregnancy (*v.* the differential diagnosis of appendicitis).

Intestinal colic may be caused by the presence of a tapeworm in the bowel, and foreign bodies such as particles of bone or fish bones may give rise to inflammatory conditions inducing symptoms resembling those of appendicitis, cholecystitis, etc.

On April 28, 1904, a nineteen-year-old tailor's apprentice was brought into the medical clinic with the diagnosis of "appendicitis." Two days before, the temperature was said to have been 104° F., but on admission it was subnormal. There was marked tenderness in the ileocæcal region and also in the left gluteal region. In the ileocæcal region a hard, pencil-like body could be felt. The patient denied having swallowed a foreign body, but just before the opera-

tion he confessed that a friend had introduced a pen-holder into his rectum. The laparotomy was performed in Hockenegg's clinic. An incision was made over the cæcum and the pen-holder was found in the sigmoid flexure with one end pressed against the left linea innominata. The flexure had a very long mesosigmoid, so that the oral end of the foreign body reached the neighborhood of the cæcum.

An official, aged thirty years, was taken in November, 1903, with pain in the umbilical region, which later centred about the gall-bladder. A Carlsbad treatment caused the pain to disappear. I saw the patient for the first time in May, 1904. He then had pain in the gall-bladder region which was increased on deep respiration and on coughing, and on bearing weight on the right foot. Lying on the side was painful. The temperature was subnormal. Taking food did not modify the symptoms. In the gall-bladder region a firm mass the size of a nut could be felt. Cholecystitis? Gumma? The surgeons declined to operate and the patient left the clinic. In June, 1905, I saw him again and he related that in April, 1905, the pain had recurred in the former situation, and the overlying skin had become red. In May, 1905, an incision was made and about two litres of pus were evacuated. In the discharge a portion of a chicken bone the length of a match was found.

3. *Visceral Neuralgias and Disorders of Circulation.*—The cause of the pain lies not in the organ itself, but in its nerve supply or in its vascular system. Experience shows that cases of this sort are particularly liable to misinterpretation because through the law of probabilities lesions of the organs themselves are more likely to be thought of.

The neuralgiform attacks sometimes occurring in spinal diseases, particularly in tabes, cerebrospinal syphilis, etc., and manifesting themselves in certain organs, such as the stomach, intestine, bladder, etc., as well as independent processes in the abdominal sympathetic and its ramifications will be taken up partly in describing the various organic

pains and partly in the discussion of the visceral neuralgias. In order to avoid repetition, reference is made to the chapters in question. On the other hand, in the chapter on the vascular system we shall discuss the manner in which anatomical changes in vessels, like dilatation, constriction, occlusion, embolism, and thrombosis, may occasion pain in the corresponding organs, and reference will be made to the importance of functional disorders like vascular spasm. It is therefore to be recommended always to keep this possibility in mind in investigating attacks of abdominal pain in which the necessary underlying factor such as mitral stenosis, or atheroma with cardiac insufficiency is present. It is well to remember, however, that these are more or less rare and that, on the other hand, circulatory disorders may give rise to abdominal pain in other, even though indirect, ways. For example, patients with portal obstruction are prone to meteorism and may suffer from extremely severe pain from flatulent colic, or there may be a secondary nephrolithiasis due to sedimentation of urine in the renal pelvis of a congested kidney, or complications like gastric ulcer or cholelithiasis whose development appears at times to be favored through the congestion.

4. *Acute Intestinal Stenoses, Hernias, etc.*—Intestinal affections from the borderland of surgery and internal medicine. Here we should first consider the pain often suddenly arising under severe general manifestations, spontaneously or after abdominal straining, and accompanying acute interfer-

ence with the passage of intestinal contents, whether produced by external or internal incarceration, strangulation, volvulus, or intussusception. Where evidence is obtained pointing in this direction, such as increased peristalsis with severe general symptoms, the subjective sensation of impeded intestinal activity, acute meteorism, etc., the most careful study of the nature of the pain is to be recommended. While the diffuse colic attending these conditions is not characteristic, the search after definite local pain phenomena may be of decisive value. It is above all necessary to determine exactly the region in which the pain began, as this may at least permit conjecture in regard to the site of the lesion. Just as in chronic intestinal stenosis the location of the pain sometimes corresponds to the situation of the obstruction, the same thing may be true in acute cases. It is of equal importance to test for local tenderness to pressure, and in this connection the various hernial openings should of course be most carefully examined.

Gall-stones or foreign bodies impacted in the intestine may also occasion atypical local tenderness which is difficult to interpret. In considering hernial pain the position of the body must be taken into account as well as the local tenderness, since it may determine the intensity of the trauma acting at the moment on the contents of the hernial canal or hernial opening. For example, the attitude of "Attention" or bending the trunk backward frequently

gives rise to pain in cases of the extremely small and therefore easily overlooked hernias of the linea alba, while on leaning forward the epigastric pain, which is frequently interpreted as due to ulcer, is relieved. When lying on the back raising the head may cause pain, or also contraction of the abdominal muscles at stool or in whistling. Abduction and forcible rotation inward of the thigh usually increases the pain of incarcerated obturator hernia.

This group of easly misinterpreted atypical abdominal pains also includes the more or less painful sensations that accompany abnormal gas accumulation in the intestinal canal. The neuropathic constitution, enteroptosis, and the tobacco habit not rarely furnish the underlying groundwork of this condition. The pain often involves the flexures of the colon, is frequently characterized by great severity and a colicky nature, and may also be accompanied by local tenderness. The occurrence of local distention may explain the circumscribed tenderness not rarely observed in cases of general peritonitis, in regions in which there appears to be no anatomical basis for the pain. (For example, on the left side in appendicitis with perforation.) In other instances, when no inflammatory condition exists, external pressure may give relief, obviously by causing the dispersal of a local accumulation of gas. The examination of the stools is of great importance and often reveals a strongly acid reaction and an abnormal flora with the presence of leptothrix-like rod forms which give the starch reaction.

CHAPTER IV.

Quality and Time of Occurrence.

Colicky Pains.—The classification of pains from the standpoint of their quality, as a rule, has but little practical diagnostic value. One group stands out distinctly, however, and that is the one comprising the pain of colic. This is characterized by a gradual onset and subsidence, that is, a wave-like curve of intensity with summits and valleys, and by the sensation of spasmodic contraction. The first peculiarity is also manifested by the pain of neuralgia, and therefore in abdominal cases the recognition of the nature of the symptom may be attended by considerable difficulty. In such instances the presence of the spasmodic element, as well as possible accompanying manifestations such as active peristalsis or borborygmi, may give the necessary clue.

Pathogenesis of the Pain of Colic.—How does the pain of colic originate? It occurs in regions where there are muscular, hollow organs and is linked with this anatomical structure. In regard to the general pathogenesis of colic, from the purely clinical standpoint I agree with those who explain the phenomenon by supposing that along the course of a muscular tube a band of spasmodic contraction approaches another fixed contracted ring, driving before it the contents of the organ. As a result of this there must

be overdistention of the constantly shortening portion lying between the two rings, and I regard this pain of distention as being the chief factor in the mechanism of the condition. It is a fact that the paroxysmal attacks of pain sometimes occurring in lesions of the renal parenchyma (nephritis, tumor, etc.) as the result of acute congestion, hæmorrhage, etc., in their qualitative shading are hardly to be distinguished from the pains of colic. Here the distention of the capsule is probably the only active factor. If the stationary ring of contraction relaxes, the formerly distended portion collapses, the tension of the wall subsides and the contents move on. This may be directly observed in cases of gastro-intestinal stenosis. The advance of the contents is rendered evident by loud borborygmi, and with their onset the pain usually subsides. Is the stationary contraction ring itself a source of pain? It is a fact that cases may be observed in which a spastic tumor at the pylorus of an entirely empty stomach suddenly appears under the palpating fingers, while at the same time severe pain is felt by the patient. As the tumor vanishes the pain also ceases. It seems out of the question in such a case to assume the existence of distention of the walls in view of the empty condition of the stomach, and observations of this sort appear to me to indicate that local spasm of the nature of the ordinary sural cramp is also capable of evoking the pain. In regard to the separate forms of colic, the differential diagnosis, etc., reference may be made to the discussion of the individual

organic pains as well as to the section on atypical abdominal pains.

For the purposes of rapid orientation in doubtful cases of colic it should be remembered that unilateral tenderness of the testicle to pressure, disorders in the evacuation of urine and in its nature, and pain on pressure in the renal region are found in ureteral colic. Elevation of temperature, ileocæcal pain, and leucocytosis accompany appendicitis. The examination may also require a search for tenderness and enlargement of the liver and gall-bladder, mesenteric or ovarian cysts, extrauterine pregnancy, tenderness about the hernial openings, gastro-intestinal peristalsis, sarcinæ in the stools and in the gastric contents which occur in stenosis of the pylorus, lead line on the gums, abnormalities of the pupillary and patellar reflexes, glycosuria and the absence of indican with peritoneal symptoms indicating pancreatic disease, glandular masses in the neighborhood of the solar plexus, menstrual irregularities, and cardiac and aortic lesions pointing to angina pectoris with epigastric localization.

The time of occurrence of the pain has differential value only if there is regularity in this, or if there is a relationship to the ingestion of food or to organic function. In this connection reference may be made to what has been said above.

Nocturnal Pains.—A special group is formed by attacks of pain characterized by more or less exclusively nocturnal onset. An undeniable relationship in this regard is manifested by: (1) The pain

of colic in general. As a physiological example labor pains deserve the first place. With the inactivity of striped muscle there seems to be associated an increased activity of the smooth muscle fibres, and it may be said that at night smooth muscle is in the ascendant. Colicky seizures of the most varied sorts show a pronounced tendency to manifest themselves during the midnight hours. Nocturnal occurrence appears to me to be of differential interest, especially in distinguishing between functional pain and that having an organic basis. If the pain wakes the patient from sleep it is usually organic in nature. (2) Neuralgias. (3) Pains due to a dyscrasia. In this category may be included the uræmic headaches, uræmic cramps of the calf muscles, and gouty seizures. The neuralgic pains complained of by diabetics also frequently manifest nocturnal exacerbations. It seems to me natural to assume that as a result of the diminution in metabolic function through the absence of muscular work and its attendant respiratory and cutaneous activity, when a dyscrasia exists the toxæmic curve ascends at night and leads to nocturnal attacks of pain. Circulatory changes also no doubt come into play. The connection between syphilis and nocturnal pain may accordingly be regarded only as a particular example of a connection actually having a much deeper foundation.

Gouty pains sometimes are severest during the morning hours. In such cases it is probably the automassage and improvement in the circulation of the

affected joints that causes the pain to grow less as the day wears on. In some forms of pain regular intermissions are due to the fact that the underlying cause is regularly intermittent, as for example fever, or the ingestion of food. Trigeminal neuralgia sometimes appears at definite hours, without depending on a masked malaria. Periodical attacks of pain at certain intervals, as in migraine, essential gastralgias, etc., suggest the possibility that the causative factor lies in the accumulation of metabolic products—for example those of the glands of internal secretion.

CHAPTER V.

The Nervous System.

HEADACHE.

This designation, although it really connotes only a topographical characteristic of the pain, is usually employed when an organic pain is in question, that is, cerebral pain. In order to justify the latter assumption, it is necessary to regard the brain, together with its enveloping membranes, as an entity, a principle that, by the way, will be found perfectly natural in the description of hepatic, splenic or renal pains, etc. Paradoxical as it may seem at the first blush to draw parallels of any sort between organs that are so different in function and structure, it cannot be denied that the general basis of the phenomena of pain in the organs just mentioned possesses certain characteristics in common. Variations in the volume of the organs with the attending tension of the capsule, and more or less independent inflammatory processes of their enveloping membranes, are important factors in the general pathology of pain involving the organs in question. For example, in proportion as the volume of a congested liver diminishes under the action of digitalis its tenderness to pressure decreases, to reappear again

suddenly at a time when auscultation demonstrates the onset of a perihepatitis. In this case the conditions are plainly evident, for the organ is accessible to direct physical examination. It is different in cases of cephalalgia, for although the ophthalmoscope may give valuable information, for the most part we are confronted by the rigid bony cranium which sets at naught our efforts in the way of physical examination. We are therefore forced to form an opinion concerning the general mechanism of pain from case to case, taking into consideration the modifying factors and the accompanying manifestations. Under these conditions it is hardly possible to avoid reasoning by analogy. The question is further complicated by the fact that we are often obliged to assume that certain persons have a predisposition to headache, without which the factors about to be discussed might be ineffective. This may to some extent depend on vasomotor instability, and accordingly headache is enormously frequent in neuropathic individuals. Local anatomical peculiarities may play a rôle, such as the size of the foramen of Magendie, and of the emissary and other venous channels. There is also evidence in favor of the view that headache is sometimes related to constitutional peculiarities, under which heading metabolic processes are undoubtedly of much importance. Thus the attacks of migraine usually cease with the onset of the climacteric. Then there are interesting cases, of which I remember several, in which the

development of leukæmia or carcinoma is attended by the cessation of previously habitual headaches.

Fundamental Causes of Headache.—Assuming the existence of such a predisposition, the following factors of general pathology may be grouped as belonging to the fundamental causes of headache:

I. Mechanical factors, involving a rise in intracranial pressure: (a) Chronic (new growths, hydrocephalus). (b) Acute. Under this heading vasomotor disturbances must be considered, such as angioneurotic hydrocephalus and also interference with the venous return, as in sinus thrombosis, paroxysms of coughing accompanying congestion in the superior vena cava in consequence of mediastinal new growths, tricuspid insufficiency, etc.

II. Chemical factors: Anæmia, toxæmia, inflammation.

III. Reflex factors.

The meninges, receiving their innervation from the trigeminal nerve, are to be regarded as the common point of attack of all these, and the peculiar nature of this nerve to some extent explains the especial characteristics of headaches.

I. Headache Due to Chronic or Acute Elevations of Intracranial Pressure.

By way of preface, it may be pointed out that increased pressure in the arterial system sometimes occurs together with intracranial hypertension, and may under certain conditions serve as a predisposing factor. On the other hand, it is evident that intracranial tension may also be increased in cases of low arterial pressure.

Brain Tumor and Hydrocephalus.—The anatomical processes to be considered in this connection are in the first place tumors, which may increase cerebral pressure partly *per se* through the increase in the bulk of the intracranial contents, but which may also do this as a consequence of their relationship to important channels such as the veins of Galen or the aqueduct of Sylvius. The latter element particularly serves to explain the fact that of the intracranial processes leading to headache tumors of the posterior fossa deserve first place. Cerebral abscesses, of course, behave in the same way. A form of hypertension headache is caused in those cases of acquired hydrocephalus of adults in which the manifestations of increased cerebral pressure arise, sometimes in stormy fashion with the symptoms of an infectious disease (serous meningitis), in other cases in a more or less insidious manner, or at least without evidences of acute infection. The etiology of these cases of hydrocephalus running a course like that of brain tumor is far from clear,

and the assumption of the existence of chronic meningitic processes is usually a mere hypothesis. Intestinal processes such as constipation with acetonuria, as well as anæmic blood changes like chlorosis, seem to have some causative influence. The headache arising under these conditions resembles, particularly in the acute cases, the headache of acute meningitis, and also, it is true, the hypertension headache of brain tumors. The headache of acute meningitis may also be included in this category.

Position of the Head.—On careful observation of such cases of hypertension headache, as I may briefly call them, it is undeniable that the position and motion of the head is of considerable influence on the pain. The patient often succeeds in reducing his suffering to a minimum by bending the head far backward and burying it in the pillow. No doubt this position produces a certain diminution of tension and may be compared to the midposition assumed by inflamed joints. On the contrary, bending the head forward appears to increase the pain, and similarly, rotation of the head is often painful, the sensation usually being experienced in the nape of the neck and sometimes apparently on the side opposite to that toward which rotation has taken place. On lying down the patients not rarely fix the head with the hand. Swallowing sometimes serves to bring on pain. The patient therefore usually attempts to bring the head into a certain "midposition" and to maintain it passively in this attitude without innervation of the neck muscles. Another

set of painful stimuli have in common the fact that through increased heart action the blood supply to the brain is increased but the venous return is inhibited. Of this description are various mechanical factors like stooping, lifting weights, sitting up rapidly or lying down quickly, the horizontal position, hard straining at stool, etc. Extreme heat may act in a similar way, and is usually not well borne. Furthermore, various chemical stimuli of a dietetic nature may be mentioned, such as the use of alcohol, tobacco, coffee, tea, etc.

Headache and Constipation.—Finally, I should like to call attention to the frequently very close relationship between hypertension headache and constipation. Practically this is of the greatest importance, but theoretically it is no less interesting. When hypertension headache appears in conjunction with constipation of long duration, for example, in chlorotic persons, together with other symptoms of intestinal intoxication like urticaria, acetonuria, etc., a causative connection immediately suggests itself, and as a matter of fact calomel is a sovereign remedy in these cases. I can also recall cases of undoubted hypertension headache in cerebral tumor in which the administration of a laxative gave prompt relief and far surpassed the effect of the antineuralgics prescribed. The connection between constipation and headache is undeniable, but the explanation of this is pure theory. The widely supported toxin theory seems to me to be not very satisfactory, or at least not of itself all sufficient, in view

of the extreme suddenness with which the pain often ceases on evacuation of the bowels. Mechanical factors seem to me more significant. In this connection the rôle played by intestinal peristalsis as an accessory to the portal circulation might be thought of as well as the interference with circulation in the domain of the superior vena cava that results through constipation and gas accumulation in the abdomen, owing to the pushing upward of the diaphragm.

Topography and Accompanying Manifestations. A topographical peculiarity of hypertension headache appears to me to lie in its preference for the nape of the neck, as well as in its tendency to radiate along the spinal column, particularly in the region between the shoulder blades. The patients frequently complain of feeling "as if the head were being split open," "as if the head would burst open," sensations that may well be in harmony with the underlying condition. Changes in the fundus of the eye are particularly prominent among the accompanying manifestations. They may be partly of purely mechanical nature, such as dilatation of the veins, or hæmorrhages; partly inflammatory in origin. In these cases there may be lymphatic congestion with an accumulation of the products of metabolism, and it may readily be assumed that not only in the optic nerve but also in the trigeminal or occipital nerves similar alterations may develop with secondary neuralgia. Pressure points may often be

demonstrated over the distribution of the occipital and trigeminal nerves. Hiccough, vomiting, and abnormalities in pulse and respiration may be regarded as vagus symptoms. Not rarely symptoms due to irritation of the optic and acoustic nerves are observed, such as spots dancing before the eyes or buzzing in the ears, as well as attacks of vertigo.

The headache seen in conditions like brain tumor and hydrocephalus which cause changes in the intracranial pressure is readily explicable on mechanical grounds, and no element of predisposition need be postulated. The case is different in the much more frequent instances of headache without any anatomical basis, the bane of the large family of neuropaths, and which we are acustomed to term "nervous" headache. This very designation involves a confession of ignorance. Since the sufferers are usually persons with undue irritability of the vasomotor system and unstable cardiac equilibrium, the thought suggests itself that here again we are dealing with disturbances of the intracranial circulation, so that one might speak of "angioneurotic headaches." All the attendant circumstances frequently exhibit the closest analogy to those accompanying the organically induced "hypertension headaches" of tumor or hydrocephalus. While in the latter the increase in intracranial pressure is permanent and of maximum degree, in their functional counterparts the rise is intermittent and at times only insignificant. The following may serve as an example:

A man of thirty-three years, otherwise well and strong, has suffered since a fall on the occiput in his ninth year from attacks of headache recurring on an average of once in three to four weeks. These begin early in the morning with pain about the point of emergence of the left supraorbital nerve. In the evening occipital pain sets in, which is so severe that the patient's eyes fill with tears. Inciting causes are pressure over the back of the head, alcohol, excessive smoking, especially of cigarettes, heat in summer, mental and physical exertion. Relief is afforded by bending the head backward until it is nearly at right angles to the spine. The most efficient antineuralgic has been a combination of codeine with a coal-tar drug, given early in the morning. The application of cold is ineffective. In the case of this constitutionally nervous individual there are no doubt occasional elevations of intracranial pressure, which may have been predisposed to by the accident in childhood.

The forms of nervous headache in which elevation of the head brings relief, and epistaxis often is followed by immediate cessation of the pain are to be included in the category of hypertension headaches. The elevation of blood-pressure which is so often seen in neurasthenics may serve as a favoring factor, and this condition always deserves consideration in the diagnosis and treatment of headache. The vasomotor origin of the pain is furthermore suggested by such attendant manifestations as redness of the face with a feeling of burning, or pallor. The effect of temperature is sometimes noteworthy, thus exacerbations often are observed during the summer months. Cold footbaths and similar measures are frequently promptly effectual.

Headaches of the type next to be discussed depend largely on the action of endogenous poisons. The conditions are not so simple, however, as in the case of the hypertension headache due to tumor

and hydrocephalus. Anæmia of the severest grades or uræmic states may run their course entirely without headache. Individual idiosyncrasies are of moment, and elevation of intercranial pressure is frequently an intermediate factor, so that the dyscrasia in question, uræmia or anæmia, for example, acts not directly but only secondarily through this mechanical means.

II. Headache Caused by Chemical Poisons.

Uræmia.—Albuminuric headache or the cephalalgia caused by renal insufficiency may be taken as a paradigm of this type, although here in addition to the toxæmic element no doubt mechanical factors, such as cerebral œdema or hydrocephalus, together with arterial hypertension, frequently play a not unimportant rôle in the pain production. The relief to the pain that frequently follows epistaxis or blood letting at the mastoid process may be explained on this basis. As with the headache of hypertension, the seat of the uræmic headache is not rarely the occipital region but in general it may be said that there are no entirely characteristic features, so that in every case of obstinate cephalalgia the examination of the urine for serum albumin is urgently demanded. The prompt effect frequently following large doses of cerium oxalate (about 0.5 g.) is an interesting fact.

In May, 1906, I was consulted by a lady of about fifty years on account of severe headache. She had never suffered in this way before, but her menstruation had ceased three months ago and since

that time the headache had persisted. The pain began over the root of the nose, and was so severe, especially early in the morning, that she had expressed her intention of committing suicide. There was also frequent vomiting. Black coffee lessened the pain, but wine or beer caused it to become more intense. She complained of loss of appetite and could not take milk or acid foods. It was found that the quantity of urine was increased, especially at night, and that it was light in color. Examination showed high arterial pressure and enormous quantities of albumin in the urine.

It is difficult to determine to what extent the headache occurring in cases of arteriosclerosis with high blood-pressure but without albuminuria depends on arteriosclerotic renal insufficiency. Here again the high blood pressure may come into play, as appears to me to be shown by the relief not infrequently afforded by an incidental nose bleed, so that the advisability of producing this artificially may even suggest itself.

Lead Poisoning and Gout.—The basis of the headache in chronic lead and metal poisoning in general is probably not constant, and the same thing is true of the uric acid diathesis and the peculiar type of headache well known to the laity as migraine. It is true nevertheless that Trousseau's classical dictum, "migraine and gout are sisters," deserves full consideration.

I remember to have seen cases of gout in which the onset of joint pain was accompanied by the cessation or lessened intensity of the attacks of migraine. (Excretion of uric acid into the joints and therefore decrease in the uric acid content of the blood?)

Infectious Processes.—The relations between infectious processes such as syphilis, malaria, tuber-

culosis, influenza, etc., and their associated headaches, are no less uncertain. In part, there may be direct toxic action on the pain-conducting trigeminal tract; in part, transitory elevations of intracranial pressure incited through inflammatory hyperæmia of the meninges and the intracerebral blood vessels. This holds also for cases of suppurative or tuberculous meningitis.

In malaria there may be regular attacks of headache, even though the fever is irregular. In one case of mine the pain came on every afternoon at four o'clock. Since syphilitics are nearly always also neuropathics, in considering their headache one must think of the possibility of its being nervous in character. This is made more probable if the pain is not nocturnal.

Anæmia.—It is undeniable that patients with blood changes, such as chlorosis or pernicious anæmia, not rarely suffer from headache, and it is equally true that headache is often entirely absent in cases of pernicious anæmia of the most severe sort. It is hardly wise therefore to speak off-hand of an anæmic headache. When headache is especially intense in anæmic patients, the idea of intracranial rise in pressure through hydremic hydrocephalus suggests itself. In such cases elevating the head is frequently of benefit, and the patients often behave in a manner similar to that discussed under the heading of hypertension headache. Just as hydremia appears to predispose to fluid exudates in general, it seems sometimes to give rise to transudation into the ventricles of the brain. This is not intended to deny, however, that anæmic blood

changes may not cause headache without an intermediate condition of hydrocephalus. These are then susceptible to the same therapeutic measures as the underlying condition and are relieved by a more abundant blood supply, such as is caused by lowering the head.

III. Headache of Reflex Nature.

Here irritative stimuli are concerned—particularly in the distribution of the trigeminal nerve—which under some circumstances may find an echo, as it were, through radiation in the meningeal distribution of this nerve. Such reflexes are especially likely to occur in cases in which a neuropathic predisposition and vasomotor instability exist. Even in cases of restricted localization it may be difficult to distinguish between neuralgia and true cerebral pain. If there is evidence of increased intracranial pressure, as in otitis media for example, all doubt is, of course, removed. At any rate, in making the differential diagnosis of headache, it is advisable not to leave out of consideration any existing manifestations in the distribution of the trigeminal nerve.

The Eye, Nose, and Ear.—This is especially true of the eye; the combination of headache and visual disturbances should always lead to the most careful examination of the eye, including investigation of the tension of the eyeball, the visual field, and examination for excavation of the optic disc. Furthermore, there is no doubt that other disturbances such as weakness in convergence, hyperme-

tropia or presbyopia, astigmatism, etc., may furnish the starting point of headache, especially in cases in which a general predisposition to headache is already supplied by other factors such as the neuropathic constitution, disorders of nutrition, etc.

The following case may serve as an example:

The patient was an anæmic lady, slender in build and of sensitive intellectual type. The vasomotor system was overexcitable, and even slight exertion caused fatigue. There was pain about the tendo Achillis on rising after sitting for some time. The breasts were tender, especially at menstruation. All the nerve trunks sensitive. She was restless and found that the quieter she was the worse she felt. At the menstrual period there was constipation which was relieved by the use of morphine suppositories. Corneal reflex and knee-jerks normal. She was near-sighted and wore glasses. For a long time she had suffered from headaches which were rebellious to the usual antineuralgic remedies. The instillation of hematropin always relieved the headache promptly. During the attacks the pupils were contracted.

More often the relation between the eyes and headache is less direct, since use of the eyes may cause an increase in headache caused by some other factor. This is true especially of "nervous" or "vasomotor" headaches. There is an undeniable relation between headache and inflammatory and suppurative disease or swellings in the nasal passages and their accessory cavities (frontal headache in iodide coryza, etc.). Particularly convincing are those cases in which months of antineuralgic treatment of obstinate frontal headache are suddenly permanently terminated by the discharge of a quantity of pus through the nose. Processes in the frontal and sphenoidal sinuses are of particular

significance in this connection. But here also the relationship is often purely superficial, and the headache depends primarily on the patient's neuropathic constitution, while the nasal condition is merely a secondary etiological factor. Overzealous treatment by specialists must therefore be deprecated and the general predisposing condition should receive full therapeutic attention. That the ear should require full consideration among the organs of special sense is evident through the possibility of otogenous cerebral abscesses, sinus thrombosis, etc. The examination of the mastoid process for tenderness should never be omitted. In case there is a purulent aural discharge the connection is particularly evident, for retention of this causes prompt increase in the often unilateral headache, which subsides again when the discharge becomes free.

Stomach and Intestine.—Any existing gastrointestinal disorders (parasites, constipation, dyspepsia, latent cholelithiasis) must also be taken into account. Just as cerebral processes like brain tumors, meningitis, or migraine frequently evoke vomiting, constipation, or other secondary gastrointestinal disturbances, a similar influence seems to be possible in the opposite direction also. Headache of this variety also frequently has a neuropathic substratum. The following are examples from my experience:

One neurasthenic patient complained of headache, especially after taking sweet or fatty foods. In another case headache of long duration was relieved on the expulsion of a tape worm. One patient

with enteroptosis and marked pulsation of the abdominal aorta suffered from pounding in the head after taking starchy desserts, while a woman with a tendency to abdominal distention found that the headache was lessened when she compressed the abdomen with a massage ball. In a case of nervous achylia the gastric disturbances were always associated with pain in the top of the head. Larger amounts of eggs or bread caused increase in the headache and the patient was accustomed to relieve himself by inducing vomiting by drinking black coffee. Another patient had temporal headache when fasting ("Hunger Headache").

Stagnation of fecal masses deserves consideration, as has already been indicated. Even though the headache may seldom be caused by constipation alone, this often affords an important contributing cause, the removal of which, as for example in cases of brain tumor, may lead to an immediate and considerable improvement in the pain.

It is chiefly the gastro-intestinal neuroses that are associated with headache, and sometimes alternate with it. Organic gastro-intestinal lesions are less often associated with it.

In one case of carcinoma of the stomach the headache was always lessened on taking food, while in another similar case it was increased when the patient ate meat and bread.

An intimate etiological relationship between headache and constipation may exist in cases of intestinal autointoxication. In these several days of constipation are followed by very severe headache frequently associated with stiffness of the neck so that the possibility of meningitis suggests itself. On emptying the bowel prompt relief is usually afforded. Acetonuria, which to be sure may also occur in

meningitis, at least in the later stages, and the absence of fever are of assistance in the differential diagnosis.

The genital system also plays an important rôle in the causation and modification of headaches. Here again overzealous special treatment must be guarded against, for the chief etiological factor usually lies in a general neuropathic tendency, which may it is true be aggravated by sexual excesses or masturbation. The following examples are referred to in brief:

In one instance severe headache appeared during several months of amenorrhœa and ceased on the return of the menstrual flow. In another case persistent occipital pain invariably stopped when the patient had an erection. In still others "habitual" headaches disappeared after marriage, or after the birth of the first child, and so on.

Differential Diagnosis.—Since headache, as has already been emphasized, is frequently based on the general constitution of the patient, or disorders of metabolism, etc., a thorough general examination is always necessary. On the other hand, consideration of the headache *per se* often shortens the diagnostic analysis, and especially investigation of its functional relations may afford a clue to the proper treatment.

Topography.—Localization of the pain at the back of the head and the nape of the neck radiating downward along the spinal column between the shoulder blades, would suggest particularly hypertension headache or renal headache, if there is no disease of the vertebral column itself or rheumatic affection

of the neck muscles. Involvement of the frontal region, on the other hand, would direct attention to functional disorders of the eye or diseases of the nose and nasal sinuses, particularly the frontal sinus. Headache felt at the vertex is nearly always of neuropathic origin. The depth at which the pain is said to be situated is always of importance. Superficial headache points to trigeminal neuralgia or rheumatic disease of the galea. Local tenderness about the top of the head should always be looked for. A fairly reliable indication of "nervous" headache lies in the fact that superficial contacts, as in combing the hair, are very painful, while deeper pressure causes no discomfort. Local tenderness frequently occurs over cortical tumors—possibly through irritation of the periosteum. Palpation also reveals any existing points of tenderness over the foramina of exit of the sensory nerves, especially the trigeminal and the occipital, or the thickenings of the skull or its coverings caused by syphilis or rheumatic affections. A unilateral headache indicates idiopathic migraine, if an appropriate history is obtained of hereditary predisposition, onset in youth, and typical accompanying manifestations like vomiting, scintillating scotoma, etc. If hemicrania begins later in life, a secondary form such as that due to tumor, nephritis, syphilis, etc., is suggested.

I recall the case of a tabetic with a history of lues, diplopia, and lightning pains, and whose pupillary reflexes were lost while the knee-jerks were present, who suffered from left-sided headache

recurring regularly every four weeks. The attacks were accompanied by vomiting and diarrhœa, which latter symptoms at times also occurred by themselves as gastro-intestinal crises.

Quality and Intensity.—The quality and severity of the pain also deserve analysis. In general the greatest intensity is exhibited by hypertension headache due to tumor and hydrocephalus, the attacks of migraine, and trigeminal neuralgia. The quality of the pain of the first-mentioned type, which is often described as "splitting," harmonizes well with the underlying process, which frequently no doubt involves a maximum of intracranial pressure. The time of onset, too, may give a clue. Headache that never appears at night is probably not of luetic origin. This is a differential point of considerable value, for syphilitics are especially prone to "nervous" headache and the time at which the pain manifests itself is of assistance in determining its nature. The reverse is not true, however, for nocturnal increases in intensity are also observed in non-luetic cerebral processes, such as brain tumor or uræmia.

Modifying Factors.—Most suggestive indications are generally afforded by a careful consideration of the conditions under which the pain is modified. In the following paragraphs especial attention will be paid to therapeutic considerations.

A. Psychical.—Less severe forms of "nervous" headache are frequently amenable to mental influences, and diversion by such measures as tennis or piano playing may be of service. Of the drugs,

aspirin in very small doses (0.25 to 0.5 Gm.) appears to work best.

B. Mechanical.—This factor comes into play especially when the pain is induced through elevations of intracranial pressure. This occurs not only in brain tumor and hydrocephalus, but also in some instances of "nervous" headache and of that due to other conditions such as anæmia and uræmia. In such cases of what may be termed "plethoric" headache, a dependent position of the head is usually detrimental. The patients therefore feel more comfortable when sitting than when lying. Epistaxis or the application of leeches is often beneficial, but stooping increases the pain. Firm bandaging of the head is sometimes effective, possibly through a reflex influence on the circulation. The part played by constipation as a mechanical factor has already been discussed on page 81.

C. Thermic.—Heat often increases the pain, and the patients suffer more in summer. This happens with especial frequency in cases of "plethoric" headache, the patients often belonging to the neuropathic class. In these cases cold footbaths of short duration appear to be particularly beneficial, while cold applications to the head are rather apt to increase the suffering even in cases in which a feeling of heat is complained of. Of course precisely in this group individual peculiarities are especially to be reckoned with.

D. Chemical.—This category includes the well-known and frequently abused antineuralgic drugs.

It is interesting to note that there are also agents which can give rise to definite cerebral pain. To this class belong the nitroglycerin and erythroltetranitrate preparations so much used in the treatment of angina pectoris. Thyroid gland and iron preparations appear also to have a similar effect.

E. Dietetic.—In this connection I would refer particularly to the frequently observed effect of even small amounts of alcohol in increasing or causing headache. The "plethoric" forms of headache are especially susceptible to the action of alcohol. Not rarely the administration of black coffee gives relief to the pain. In neurasthenics with rheumatic tendencies the consumption of large quantities of meat may bring on a headache.

In this way the analysis of the pain itself will frequently guide the examiner in one direction or another, even though the diagnosis does not at once follow. The careful and detailed general physical examination is not to be avoided in this way, but may be shortened. Certain tests are always to be recommended for the purpose of rapid orientation:

1. Estimation of the blood-pressure and of any existing vascular changes (nephritis, angiosclerosis, lead poisoning).

2. Pulse rate (bradycardia in tumors, hydrocephalus, meningitis).

3. Examination of the urine for serum albumin and acetone. In intestinal autointoxication the latter appears early, but in meningitis later.

4. Testing the intra-ocular tension in order not to overlook a case of glaucoma.

5. Ophthalmoscopic examination of the fundus of the eye.

6. Testing the patellar reflex, which may be absent in cerebellar tumors or meningitis.

7. Testing the pupils (syphilis and meningitis).

Among the cranial nerves the facial and hypoglossal deserve most attention, as slight disorders of either of these do not give rise to complaint and are therefore easily overlooked.

In taking the history, attention must be paid to such accompanying manifestations as vomiting, which suggests hypertension headache, migraine, or glaucoma, and acute disturbances of vision indicating migraine, glaucoma, or nephritis. The matter of preceding or still existing nasal or aural disorders should also be investigated. Lacrimation or secretory disturbances of the nasal mucosa or salivary glands, accompanying the attacks of pain, arouse suspicion of the existence of trigeminal neuralgia.

NEURALGIAS INVOLVING THE GENERAL NERVOUS SYSTEM.

Inasmuch as every stimulus requires transmission by the nerve trunks in order to be experienced as a sensation, it at first seems rather paradoxical to speak of "nerve pains" as a distinct variety. Clinically, however, this term connotes the conception that the source of the pain is not to be found

in the parenchyma of an organ, from which it is transmitted to the sensorium through the special nerve trunk belonging to the organ, but rather that it acts upon the sensory trunk itself in its peripheral portion. The first task of the diagnostician is to discover, as far as possible, the seat and variety of this cause. If this attempt is not successful the assumption is warranted that there is present a neuralgia in the more restricted sense; that is, a nerve pain concerning whose etiological basis biochemical information is not yet available and histological investigations will probably never enlighten us fully. It is therefore necessary to keep in mind that the diagnosis of neuralgia in its restricted sense is a diagnosis by exclusion and that up to a certain point it remains doubtful. Repeated reinvestigation in regard to the etiology is accordingly extremely desirable.

The point of attack of the neuralgia-producing factor is probably in most cases to be found in the course of the peripheral neurone. Nevertheless it is desirable to remember that the central conducting tracts, the medulla, pons, optic thalami, and their surroundings, and probably also the cerebral cortex, as well as the posterior portions of the gray matter of the cord, may be the seat of the disease. In these anatomical districts pain may be produced, not only as the result of organic, but also from functional disturbances. The neuralgias arising in hysteria, cerebral tumors, tabes, syringomyelia, myelitis, etc., are probably to some extent to be interpreted as

having a central origin of this nature. Much more varied are the general and special factors that give rise to neuralgias in the peripheral nervous system. As it seems advisable to pass these in review in every doubtful case, I wish to make at least the attempt to arrange them in classified form.

A. Direct Factors.

1. *Mechanical.*—These are principally pressure effects through new growths, particularly glandular swellings, aneurysms, inflammatory processes with exudation in the neighborhood of nerves, hernias, etc.

2. *Thermic.*—This group includes the complex of stimuli comprised under chilling, draughts, etc., the mode of action of which is difficult to analyze. The underlying cause frequently lies much deeper and the thermic stimuli have only an exciting effect.

3. *Chemical Factors with Secondary Disorders of Nutrition.*—Their point of attack is certainly often indirect, involving the vascular system. Sclerotic and spastic conditions in the domain of the vasa nervorum must not be forgotten in this connection.

(a) Non-infectious exogenous toxins: Protoplasmic poisons of the most varied nature would be included here, such as arsenic, lead, alcohol, nicotine, mercury, etc.

(b) Toxins infectious in nature: Syphilis, malaria, influenza, tuberculosis, gonorrhœa, etc.

(c) Dyscrasic endogenous toxins: Gout, carcinoma, diabetes, nephritis, anæmia, adiposis dolorosa of Dercum.

Here may best be included also those local disturbances of metabolism that underlie the so-called occupation neuralgias which result from the excessive use of certain nerve tracts. Furthermore the attacks of pain involving the distal portions of the extremities and accompanied by vasomotor disturbances, such as erythromelalgia, Raynaud's disease, etc.

B. Reflex Factors.

The stagnation of fecal masses, intestinal parasites, various visceral disorders involving the heart, gall-bladder, genital apparatus, kidney, etc., may be concerned in the causation of neuralgias, and it is natural to assume a reflex element under these conditions. On the other hand, neuralgias in certain nerve tracts may incite neuralgias elsewhere as through the sympathetic vibrations of musical strings.

How is a Neuralgia to be Recognized?—As regards the diagnosis of neuralgias as such, the recognition of the fact that a pain corresponds topographically to a peripheral sensory nerve tract, and like this exhibits a linear rather than a diffuse distribution, is frequently sufficient to establish the nature of the case. Naturally it is not enough to determine only the spatial limits of the spontaneous pain, but the presence of painful pressure points should also be sought for. This is the more impor-

tant since in this way latent neuralgic conditions not manifesting themselves spontaneously may be detected. For example, in angina pectoris I have seen tenderness of the left brachial plexus even between the attacks. The pressure points usually correspond to those portions of the nerves which are subject to trauma through their superficial position, a firm or bony substructure, etc., but as these are not constant there is little wisdom in overloading the memory with ballast of this nature and anatomical knowledge is the best guide. In addition to the mechanical factor of pressure, traction may be used for evoking the pain experimentally. This is true for the trigeminal nerve (movement of the lower jaw), the occipitalis major (rotation of the head), and the sciatic nerve (flexion at the hip joint with extended knee). The susceptibility to influence in this way may also, however, lead to confusion with muscle, joint, or bone pains, and caution is necessary in interpreting the results. The anatomical unity of the pain may be entirely upset through the involvement of bone, periosteum, muscle, and joint nerves in the neuralgic process, and these possibilities must always be reckoned with. Paroxysmal onset (frequently at night) is a common characteristic of neuralgic pains. At any rate, the mere fact of nocturnal occurrence does not justify the conclusion that syphilis is the underlying factor, although in general the absence of nightly exacerbations may be used with some probability as being against syphilis. The periodical onset of the pain

and its relief by quinine may find its explanation in the malarial nature of the neuralgia, but this is not necessarily so.

Site of the Lesion, whether Central or Peripheral.—After a painful condition has been identified as a neuralgia, it is always necessary to determine the site of the lesion. The possibility of cerebrospinal localization (brain tumor, tabes, syringomyelia, syphilitic spinal meningitis, etc.) must always be thought of, and the reflexes and possible disorders of motility, like flaccid or spastic paralysis, ataxia, vesical or rectal disturbances, should be considered. After determining the peripheral character of the neuralgia the question of etiology arises, and in regard to this reference may be made to the classification given above. It is of the greatest practical importance not to overlook a beginning new growth, to think of the possibility of cardiac or aortic lesions, and to guard against failure to recognize some dyscrasic factor by careful examination of the urine. The possibility of reflex origin must also always be given due weight.

The Face.

In order to determine the causative factor in cases of trigeminal neuralgia, the course of the nerve from the Gasserian ganglion onward should always be kept in mind, so that such conditions as tumors of the nerve itself, aneurysms of the internal carotid, destructive processes of the meninges and at the base of the skull, like tuberculosis, syphilis,

carcinoma, actinomycosis, etc., may not be overlooked. The distribution of the nerve must also be considered and the processes in the eye, teeth, alveolar cavities, nose, ear, etc., that may come in question. In infectious processes the discovery of pronounced tenderness at the point of emergence of the supra-orbital nerve suggests influenza, typhoid fever, or malaria. Under these conditions, however, as well as in meningitis, it should not be forgotten that the pain on pressure may be only a part of the general hyperæsthesia. Of the reflex etiological factors, reference may be made particularly to the stagnation of fecal masses and disorders of the female genital system. There is no doubt that at times, as in cases of headache, a laxative is the best antineuralgic remedy and dietetic treatment may also be of service.

I remember the case of an older patient with arteriosclerosis and high blood-pressure, who stated that for eight years he had pain almost every other day about the left supraorbital nerve. All sorts of antineuralgic remedies were resorted to, but the only thing that proved effective was black coffee. Caffeine did not give relief.

Similar conditions also obtain, both in trigeminal neuralgia and in headache, in regard to the general pathological conditions, as is not surprising when one considers that the dura mater is supplied in part by the trigeminal nerve. Accordingly, trigeminal neuralgias, like headaches, are susceptible to mental influences and are not rarely greatly aggravated by excitement. The underlying conditions that give rise to the symptom complex of angina pectoris must also be counted among the reflex visceral

factors. It is true, however, that isolated trigeminal neuralgia is unusual under these circumstances, although unilateral radiation in the districts of the third and second branches, with pain in the teeth, is not of exceptional rarity. It seems that there is great likelihood of the radiation occurring through the vascular channels, perhaps owing to spasmodic conditions due to the sclerosis.

The Occipital Region and Nape of the Neck.

Of the sensory tracts supplying this region there may be mentioned, toward the midline the occipitalis major, more laterally the occipitalis minor, and still further outward supplying the posterior surface of the ear, the auricularis magnus. Occipital neuralgias may frequently be explained on the basis of the general causes summarized on page 99. The abuse of tobacco is especially significant. Of the organic lesions diseases of the vertebral column and of the meninges of the cervical portion of the cord have a particular etiological bearing. Since the second cervical nerve—whose posterior branches, as the occipitalis major nerve, supply sensory filaments to the skin of the occipital region—passes between the atlas and axis, the occurrence of mechanical injuries in this region may be readily understood through the great mobility of the parts. At the same time, the fact is explained that neuralgia of this region may restrict the movements of the head, although the muscles and joints themselves are not involved. Neuralgias in this situation are probably also caused mechanically in cases of elevation of the

intracranial pressure, especially when due to processes encroaching on the posterior cerebral fossa, as in hydrocephalus following serous meningitis (Quincke) or due to chlorosis or tumors of the posterior fossa.

Of the visceral diseases chronic nephritis seems to me to be particularly prone to give rise to occipital neuralgia, perhaps through intracranial elevations of pressure. In addition, glandular processes (lymphosarcoma) and more rarely aneurysmal dilatations of the vertebral artery may come in question.

The Arm.

The neuralgias occurring in the brachial plexus and involving especially the ulnar and radial districts, may be caused either through direct or reflex factors.

1. *Direct Causation.*—In addition to spinal disorders like tabes, syringomyelia, etc., one should think of vertebral disease, supraclavicular or axillary compression by glands, aneurysmal dilatations of the subclavian or innominate arteries, and the presence of cervical ribs. The brachial plexus may also be directly involved in cases of inflammatory processes or malignant growths of the apical pleura, and in this way spontaneous brachial neuralgia—or at least tenderness of the plexus—may result. I have formerly directed attention to this symptom of "unilateral plexus tenderness" in incipient phthisis, and have frequently made use of it to

good advantage. Abnormal exhaustion of the nerve tracts through local overexertion, as in piano playing, and the general causes of neuralgia (page 99) must also be kept in mind.

2. *Reflex Causation.*—The neuralgic conditions of the brachial plexus, whether spontaneously painful or existing only as a latent neuralgia manifesting itself by tenderness on pressure, may overstep the purely neurological limits since they not rarely are accompanying evidences of visceral lesions. Sometimes, though less often, they present a certain degree of independence, or may be accompanied by mild motor manifestations of a paretic or spasmodic nature.

The occurrence of neuralgic sensations in the province of the left ulnar nerves is always noteworthy, especially when appearing in conjunction with exertion as in stair climbing or running. A premonition of angina pectoris is suggested.

A neuropathic constitution undoubtedly affords a favorable soil for radiations of this sort. The thoracic viscera, particularly the heart, pericardium, and large vessels, as well as the diaphragm and the abdominal organs coming in contact with it, are likely to be concerned in this way. The side of the organic lesion then usually corresponds to the side of the plexus neuralgia. There is no doubt that the phrenic nerve is the reflex tract in many such cases, and therefore tenderness over the third and fourth spinous processes should always be looked for.

Particular emphasis may be laid on the fact that sometimes spontaneous pain may be absent while

the pressure tenderness is constant, as in angina pectoris or perisplenitis. In discussing the separate organic pains, these reflex arm and shoulder neuralgias will be explained in detail, and in order to avoid repetition reference is made to the sections in question.

Intercostal Spaces, including the Upper Abdomen.

The intercostal nerves, whose lower branches send sensory fibres also to the upper portion of the abdominal wall, very frequently cause spontaneous pain, but still more often occasion tenderness to pressure. In addition to localized central processes like spondylitis, tabes, syringomyelia, etc., it is especially internal diseases that are accompanied by either tenderness or spontaneous pain in the regions supplied by the intercostal nerves.

Diseases of the lung, and particularly of its pleural covering, deserve first place in this connection. In nearly all cases of pneumonia and pleurisy the intercostal spaces are sensitive to pressure, notably in the axillary region, although it must remain an open question whether the tenderness does not depend on direct mechanical trauma to the inflamed pleura and whether there may not also coëxist an inflammatory condition of the intercostal musculature transmitted through the lymphatics. It is suggestive that the tenderness in cases of pulmonary infarct and tuberculosis frequently corresponds exactly to the site of the infarct or infiltration, and shows no relation to the usual pressure points of

intercostal neuralgia. Suppurative pleural exudates are likely to be accompanied by special tenderness, while pleural processes accompanied by contraction only rarely give rise to severe neuralgias.

Diseases of the circulatory apparatus, such as mitral stenosis, are frequent causes of intercostal neuralgia. Usually the pain is located on the left side in the neighborhood of the apex beat. In acute pericarditis and acute endocarditis similar neuralgic sensations may be experienced. In the course of acute articular rheumatism due consideration should always be given to such manifestations in the cardiac region. Acute angina pectoris may begin as a left-sided intercostal neuralgia. Atheroma of the intercostal arteries with constriction at their origins may give rise to intercostal neuralgia. The mode of origin of intercostal neuralgia in dilatation of the aorta and mediastinal new growths demands no explanation; no doubt in addition to direct trauma reflex stimuli also come into question just as for the brachial plexus, especially for the upper intercostal spaces. The aneurysmal neuralgias of direct causation are not rarely characterized by dependence on exercise and position, owing to stronger pulsation of or dislocation of the sac. Diseases of the subdiaphragmatic organs like cholelithiasis, perihepatitis, pyloric ulcer, and perisplenitis are also prone to cause tenderness of the axillary portions of the lower intercostal spaces on the corresponding side. If the liver or spleen is in-

volved the area of tenderness often coincides with the dulness, and this may be of diagnostic importance. Here, no doubt, reflex stimuli are concerned similar to those causing the hyperæsthesia of certain spinous processes that is frequently also present. In pyloric ulcer and cholelithiasis this tenderness to pressure and percussion often occurs over the twelfth thoracic vertebra. In cases of sudden intense intercostal neuralgia the imminent onset of herpes zoster should be thought of. The intercostal neuralgia frequently accompanying kyphoscoliosis also deserves mention. This may lead to the erroneous diagnosis of pleurisy, for at the site of the pain atelectatic crackles suggesting friction sounds are often heard.

The Flanks and Lower Abdominal Region.

Leaving aside the neuralgias of spinal origin which have already been spoken of several times, idiopathic conditions of this sort are rare in the present regions. Of the intra-abdominal causes, retroperitoneal processes such as glandular masses, aneurysm of the abdominal aorta, and renal diseases at once suggest themselves. The renal causes include tumors pressing on the nerve trunks passing over the posterior surface of the organ, inflammatory and suppurative processes, or perinephritic cicatrization following infarct, etc.

Another etiological factor is formed by hernias which may induce neuralgia through pressure along the hernial canal.

Lower Extremities.

Reflex neuralgias due to disease of the internal organs like the kidney, appendix, and female genitals not rarely occur in the thigh. These forms are less common, however, than those due to disorders of metabolism like gout or adiposity and based on the neuropathic constitution. Such neuralgias, like various forms of rheumatic pain, are prone to be at their worst in the early morning, and may be aggravated by walking so that the erroneous diagnosis of intermittent claudication due to vascular disease may suggest itself.

1. *Anteriorly and Internally* (*Crural Nerve*).—Pain of the same linear distribution as that of neuralgia may sometimes be caused by phlebitic processes in the internal saphenous vein. It may also be the result of femoral hernia and may stand in relation to diseases of the kidney such as nephrolithiasis, and of the appendix or the female genitals.

One patient complained that following a miscarriage she frequently suffered from pain extending down the front of the thigh to the knee, more in the right side than on the left. As a girl similar pain had appeared a few days before each menstruation. In addition there were migraine and brick-dust sediment in the urine. Here the genital system formed the starting point of the neuralgic condition which was predisposed to by the neuropathic constitution.

The possibility of renal origin must be considered when there is at the same time tenderness of the flank on the same side.

A patient had pain in the left side extending downward along the front of the left thigh. After similar sensations had been felt

for a short time on the right side a white, friable concretion was passed.

Beyond this, reference may be made to the general underlying causes of neuralgic pain (*v.* classification on page 99).

2. *Externally.*—The neuralgias occurring in the district of the external cutaneous nerve, and therefore involving the external and posterior surface of the thigh from the iliac crest to the knee, are not usually founded on causative factors specific for the locality. The etiological possibilities coincide with those of neuralgia in general, and therefore include trauma, gout, syphilis, tabes, pernicious anæmia, etc. As the nerve traverses a fibrous canal in the fascia lata of the thigh, it is not astonishing that tension of this structure, such as is caused on standing or walking, easily produces exacerbations of the pain, whereas rest brings relief.

3. *Internally.*—Neuralgias involving the region of the adductors of the thigh always suggest the presence of a possibly incarcerated obturator hernia, especially if the thigh cannot be approached to the midline.

4. *Posteriorly.* (*The sciatic plexus.*)—The pain that is principally concerned under this heading is linear in distribution and often extends down the entire posterior side of the lower extremity. Even the laity usually interpret this correctly as a "nerve pain." If there is in addition tenderness over the course of the nerve and pain on stretching it by forcible flexion at the hip with extended knee, there

is little room for doubt. Diseases of the hip joint differ in that flexion of the hip is painful even when the knee is kept flexed. It is the duty of the physician not to rest content with the diagnosis of sciatica, which may already have been made by the patient, but to investigate the particular source of the trouble, and here as in neuralgias in general I think that I may formulate the rule: If nothing is found, search further. The scheme of causes given above may serve to aid in the general task of orientation. Examination of the rectum and vagina should never be omitted in order that any possible pelvic lesions, such as new growths of the intestine or pelvic bones or tuberculous disease of the pelvis, may be detected, and the patient's general condition (emaciation, etc.) should be carefully considered.

The degree of fulness of the rectum should also be taken into account; there is no doubt that a connection exists between fecal stagnation and pain in the sciatic plexus, though it is difficult to express an opinion in regard to the details of the relationship. Usually the condition is merely a predisposing and not a causative factor. Before deciding to accept the assumption of a purely mechanical direct action of fecal masses on the nerve plexus, it is advisable to think of the association that may exist between headache or trigeminal neuralgia and constipation, and of the fact that fecal accumulations probably also serve to increase pain through the interference with venous return (vasa nervorum). The possible existence of external or inter-

nal varicosities (involving the nerve sheath) with phlebitic or thrombotic processes must always be thought of. In respect to the venous circulation the conditions are much more unfavorable in the lower extremities than in the upper. Bilateral pain always suggests median lesions involving the vertebral column or spinal cord, or diffuse dyscrasic disorders like diabetes. Pain of maximum intensity that is refractory to all treatment sometimes is encountered in tumors of the cauda equina. A careful examination of the nervous system, with special attention to the tendon reflexes of the lower extremities, bladder disturbances, atrophies, etc., should never be omitted.

NEURALGIAS INVOLVING THE SYMPATHETIC SYSTEM AND THE VAGUS.

A priori the assumption suggests itself that the neuralgic manifestations just described for the cerebrospinal system may also, in the presence of the corresponding etiological factors, occur in the separate portions of the sympathetic system and the viscera supplied by it. This view is fully confirmed by the clinical observations. The task of correctly interpreting visceral neuralgias of this sort is, of course, much more difficult. In this case one is dealing not with the anatomically distinct, simply constructed, and directly accessible nerve tracts of the cerebrospinal nervous system, but with plexuses and groups of ganglia for the most part inaccessible to physical examination. The problem is further com-

plicated by the fact that the separate networks have as end stations organs like the stomach, intestine, ureter, genitals, etc., in which painful lesions may originate primarily. Theoretically three possibilities may be considered and in practice these are shown to be well founded.

(a) *Simple Neuralgia.*—The pain-producing process is a neuralgic condition in one of the important tracts of the vegetative nervous system, and the corresponding organ is anatomically intact. Gastric crises may be regarded as an example of this sort and a counterpart in the province of the cerebrospinal system would be neuralgia of the second and third branches of the trigeminal nerve without any disease of the teeth.

(b) *Simple Organic Pain.*—The pain has exactly the same character in regard to localization, quality, accompanying manifestations, etc., but is the result of an anatomical or functional disorder of the organ itself. As a paradigm reference may be made to the pain of gastric ulcer or to that of a carious tooth. Recently an attempt has been made to argue away the existence of stomach pains as such and to regard the cause of every gastric pain as being a sympathetic neuralgia. This is entirely inadmissible and in opposition to the facts of clinical observation. One has only to think of the stomach-ache that is promptly checked by a dose of alkali or by the administration of local anæsthetics such as anæsthesin or cocaine. The same thing is true of pyloric stenosis, and the explanation offered by the advo-

cates of the theory just mentioned to the effect that the sympathetic nerves are compressed by the distended stomach is extremely improbable. The existence of true gastralgia, resulting from purely local anatomical and functional disturbances, is as certain as the occurrence of pain in dental caries.

(c) *Mixed Forms.*—I believe that a combined form of visceral pain is not at all rare in which both the sensory-conducting tract and the organ in question play a distinct *rôle* in the causation of the pain; as an example, trigeminal neuralgia and painful dental caries may be mentioned. Such a combined origin of pain in the sympathetic and vagus districts is probably commoner than is ordinarily supposed, particularly in neuropathic individuals. It is conceivable that the anatomically or functionally active organic process might arise only secondarily as the result of atrophic disturbance due to a primary neuralgic condition, but the reverse is also probable, as well as coincident causation. When such mixed forms of visceral neuralgia are in question, it is clear that, to continue the example chosen above, the extraction of the decaying tooth may bring relief commensurate with its component of painful sensation, but the pain will continue as long as the neuralgic condition of the trigeminus does not improve. In the same way, in other cases of mixed form, the same attacks of pain may recur after the removal of gall-stones or the treatment of a pyloric stenosis by gastro-enterostomy. Through exact analysis of the conditions, as well as the study of

the psychical make-up of the patient, it is possible from case to case to interpret these mixed forms correctly and to determine approximately the relative proportions of the two components. Sometimes a mighty organic kernel is surrounded by only a thin functional shell, but more often the reverse is true. Cases of the latter sort never belong in the province of the surgeon. The prognostic and therapeutic importance of careful analysis of the possibilities in such cases is self-evident.

Etiology.—As far as the etiological sources of the visceral neuralgias are concerned it may be said that there is a far-going, deep-seated correspondence between the cerebrospinal and sympathetic nervous systems. In this connection reference may be made to the scheme of causes given above as well as to the section on gastralgia.

How may a Visceral Neuralgia be Recognized? The diagnosis of a visceral neuralgia is probably one of the most difficult of differential problems and can never be made with absolute certainty, as it is nearly always a diagnosis by exclusion. For example, what is known concerning the positive symptoms of a neuralgia of the cœliac plexus is so inadequate and so vague that a conscientious clinician would never venture to make this diagnosis directly. The cause of pain induced by deep pressure over the abdomen is difficult to determine. Whoever is anxious to discover tenderness to pressure of the sympathetic fibres or of the solar plexus will usually succeed in doing so! If the psychical equilibrium is

intact, there is no neuropathic tendency, and etiological factors of the variety in question are absent, one should be very reluctant to think of a visceral neuralgia. But in this neurasthenic age cases that comply with these requirements are very rare, while on the other hand, even serious nervous disturbances do not exclude the possibility of an organic lesion as the basis of the pain, the more so as they may be secondary. The important general rule of unity of etiology in disease is open to many exceptions in this province, and painful states due to a combination of functional and anatomical components are certainly very numerous.

Topography.—The topography of the pain usually has no differential significance. The distribution of the pain in a neuralgia of the ureter depending on chronic lead poisoning is the same as that caused by the passage of a concretion, and hysterical angina pectoris radiates in the same way as the true organic type. Essential gastralgias, it is true, are rarely asymmetrical in their localization, in contrast to the pain of ulcer and pyloric stenosis, and this is particularly true of the tenderness to pressure. The latter symptom, to be sure, is often absent in cases of essential gastralgia. Gastric crises, however, with their tendency to a left-sided localization, at least so far as the spontaneous pain is concerned, form an exception to the rule.

Modifying Factors.—A careful study of these is always of great importance. Whenever reflex involvement is evident, as, for example, in cases of gastric pain at the time of menstruation, it is per-

missible to think of a simple visceral neuralgia, but it should not be forgotten that the pain of ulcer or biliary and appendicular colic may be induced through the profoundly disturbing process of menstruation. In general, it may be regarded as positive evidence of the existence of a pronounced functional component if a sedative régime comprising general hygiene and psychical rest, the diversion of the attention, and administration of quieting drugs like the bromides or valerian, has a notable and persistent effect on the intensity and frequency of the pain. On the other hand, it is fair to assume a prominent local component when purely topical treatment like the administration of alkali in gastric pain is promptly effective. Serious consideration must be accorded to mechanical factors and their effect. If a given position of the body always causes prompt increase in the pain, it is natural to think of a localized anatomical lesion of the organ in question (*cf.* p. 24). The most exhaustive physical and functional examination of the organ that apparently is involved and the consideration of its secretions or excretions is of course of the greatest importance in reaching a decision.

CHAPTER VI.

Organs of Motion.

I. JOINT PAINS OR ARTHRALGIAS.

Topography.—In view of the clearness of the topographical relations and the ease of accurate functional examination, it is ordinarily not difficult to identify an arthralgia as such. Only when the joints concerned are difficult of access, like those of the vertebral column or of the sacro-iliac synchondrosis, or are abnormal (manubrium-corpus), are difficulties to be expected. Sometimes, however, the topographical considerations themselves may lead astray, as an illustration of which may be cited the pain in the knee that so often precedes coxitis in young persons. On the other hand, it is always our duty not to remain satisfied with the general diagnosis of arthralgia but to determine which anatomical component of the articulation is the seat of the pain. Accordingly, the articular extremities of the bones, the fibrous capsule, the neighboring tendons and tendon sheaths, and adjoining muscles must all be tested as regards painfulness. The examination must include all structures standing in anatomical relationship to the joint capsule, such, for example, as bursæ, nerve trunks, vessels, or fibromas in the subcutaneous tissues. It is also necessary to distinguish between deep-seated and superficial pain. Functional arthralgias of the sort that sometimes

occur in neuropathic individuals are not rarely accompanied by marked cutaneous hyperæsthesia without deep-seated tenderness, so that in functional coxalgia forcible pressure of the head of the femur against the acetabulum is easily borne, although even gentle touching of the skin gives rise to pain.

In general it may be said that arthralgias do not radiate. The necessary conducting tracts are wanting, a condition in contrast to the joint pains of neuralgic origin, such as the shoulder pain of angina pectoris. An exception to this rule is formed by coxalgia; in this the pain may radiate down the thigh toward the knee. The same thing is true for the ankle joint in flat foot. In other articular conditions radiation is generally to be expected only in cases of neuritic or spinal complications, such as tabes or syringomyelia, or if the pain is purely functional in nature.

Intensity.—Assuming a normal nervous system, the severity of the pain seems to depend on the degree of acuteness in onset as well as the intensity of the inflammatory process, and therefore many cases of acute polyarthritis, gonorrhœal joint affections, and gout are highly painful. When the nervous system is in a state of hypersensitiveness (hysteria) a disproportion may be observed between the objective conditions and the subjective sensations, but this by itself may not be sufficient to exclude the organic nature of the affection. Where, however, the pain-conducting tract is damaged, as in tabes and syringomyelia, one must be prepared to en-

counter very slight degrees of pain or even the total absence of this symptom in spite of anatomical changes of considerable extent, and this discrepancy may direct the attention into the proper channel.

Relations in Regard to Time.—The relation of joint pains to time can be made use of only with great caution in differential diagnosis. The occurrence of nocturnal exacerbations is frequently pointed out in cases depending on syphilis in the secondary or tertiary stages. The absence of nocturnal increase may in general render syphilis less likely, but its presence is far from rare in non-syphilitic conditions also, and may occur often enough in cases of ordinary acute polyarthritis and especially in gouty arthralgias. Only the functional arthralgias of neuropathic nature seem never to be accompanied by nocturnal increase in pain. The occurrence of arthralgias during pregnancy or in the puerperium always suggests gonorrhœa (lighting up of old foci) or sepsis.

Modifying Factors.—Among the most important characteristics of a joint pain is its susceptibility to mechanical influences. These may vary in nature, and the two most important are (1) pressure in the neighborhood of the joint (effect on the bone ends, capsule, etc.); (2) active and passive motion.

1. In examining joints, particularly when the larger ones are involved, one should never omit to investigate the possibility of a bone process, such as tuberculosis, syphilis, or osteomyelitis, as the underlying cause of the joint affection, and for this

purpose the articular extremities of the bones should be carefully palpated and be pressed against each other. No less care should be used in examining the fibrous capsule and tendon sheath.

2. The production of pain through active and passive motion is of course one of the chief evidences of an arthralgia. It should be remembered, however, that motion of a joint may also give rise to pain through traction on inflamed muscles, nerve trunks, or vessels (*e.g.*, the shoulder pain in aortalgia) without there being any lesion of the articulation itself. If, however, even slow motion of very slight extent causes pain the diagnosis of arthralgia receives greater justification. These are cases in which immobilization of the joint is the best analgesic, but in functional arthralgias fixation is very badly borne. This fact may be of differential diagnostic value as well as the noteworthy difference between superficial and deep tenderness. The mechanical factor of trauma may be the inciting agent of both functional and organic arthralgias.

Therapeutic Influences.—The mechanical factors are supplemented in their action by chemical agents. This is especially the case from the therapeutic standpoint, but may also be made use of in differential diagnosis. Only in exceptional cases are gonorrhœal joint affections and the arthralgias of rheumatoid arthritis and gout favorably influenced by the salicylates. Mercury and iodine again are particularly effective in cases of syphilitic arthralgias.

Accompanying Manifestations.—Not rarely the pain may be practically the only manifestation of the joint affection, and this is not exclusively the case in functional arthralgias, but may occur in organic lesions. The harmful agents attacking the joints may also invade the muscular and nervous systems (neuritis), and such complications must be thought of in testing for tenderness on pressure. Possible involvement of the bones, as in syphilitic periostitis, the growth of osteophytes, erosion of the articular surfaces, etc., must be thought of. Where fever is an accompanying symptom the bacteriological cause of this should be determined if possible and efforts be made to discover the primary focus of infection. This may be sought for in the tonsils, accessory nasal cavities, the middle ear, the urethra, prostate, parametrium, etc. Particular attention should of course also be given to cardiac changes.

Etiology.—In the foregoing the recognition of an arthralgia as such has been discussed, and from a consideration of the facts elicited in this way much light will often be thrown on the etiology of the process. In analyzing the underlying condition the following classification may be found of service:

1. Arthralgias of infectious origin: a, acute; b, chronic.

2. Arthralgias due to disorders of nutrition or metabolism: a, local, *e.g.*, pain about the knee with effusion into the joint in popliteal aneurysm; b, general, caused by gout, syphilis, etc.

3. Arthralgias of neurogenous nature.

1. The streptococci require special consideration under this head as the inciters of the ordinary acute polyarthritis, or of sepsis. Other organisms of importance are gonococci and the pus-producing cocci in general (staphylococci, diplococci, and meningococci), and of less frequent occurrence—excepting the tubercle bacillus—bacilli such as those of typhoid fever, dysentery, leprosy, and influenza. Diseases like scarlatina, variola, parotitis, and syphilis are also to be thought of in this connection.

2. Under this heading are grouped the arthritides of the uratic diathesis and its variants, the arthritis of lead poisoning, and the joint processes sometimes accompanying psoriasis, as well as many cases of chronic polyarthritis, although in these the possibility of an infectious etiology must always be kept in mind. The cases of intermittent hydrops of the knee and the joint conditions of hæmophilia may also be included in this class. The position of arthritis deformans is not yet clear.

3. The arthralgias of neurogenic nature, such as those of tabes and syringomyelia are ordinarily characterized by slight intensity which may diminish to almost nothing. They therefore offer a striking contrast to the arthralgias sometimes occurring in neuropathic individuals and forming an articular manifestation of hysteria.

II. MUSCULAR PAINS OR MYALGIAS.

Tenderness on pressure over a muscle and pain which is increased on passive stretching or active contraction, form the most important indications for

the diagnosis of a myalgia. In dealing with the extremities and with the musculature of the head and neck the problem does not ordinarily present great difficulties, providing that there are no painful inflammatory conditions of the overlying skin and subcutaneous tissues.

Sources of Error.—It is hardly necessary to point out how puzzling it may be to interpret correctly pain in the region of the diaphragm. Difficulties may also be encountered in investigating the musculature of the chest, the back, and abdomen, since functional examination may not give satisfactory results or may be hard to carry out, and the pain on pressure may be referable to underlying organs. In this regard it is important, particularly in dealing with the abdominal muscles, to ascertain whether, when the muscle is in a state of contraction, it is equally or even more tender. If the sensitive point is situated beneath the muscles a decrease or disappearance of the tenderness may be expected, as the contracted muscle yields but little to the pressure. Reference may also be made at this point to the myalgias frequently occurring in laborers through muscular fatigue or the effects of exposure. These are particularly frequent in the thoracic muscles, and as the pain is increased by respiration owing to the functions of the muscles involved, suspicion of pleural processes is easily aroused. In these cases it is important if possible to raise the muscle from its underlying structures and test it for tenderness by taking it between two fingers. In gen-

eral the tenderness is increased when the muscle is contracted. I should also like to call attention to the tenderness of the abdominal muscles, particularly in the epigastrium, which is not uncommon after severe protracted coughing, as in phthisis. If there happen to be at the same time abdominal symptoms such as gastric disorders, diarrhœa, etc., confusion may easily arise and the pain of gastric ulcer or peritoneal irritation be thought of. The same thing is true in regard to myalgia coming on acutely after the lifting of heavy loads, which may persist for months. In cases in which the diseased muscle belongs to the deeper layers, *e.g.*, the deep muscles of the neck, diagnostic difficulties may present themselves, and there is danger of confounding the condition with a bone lesion.

General Pathology and Etiology.—In discussing the general pathology of muscular pain, the fact must be emphasized that the chief site of the sensation is probably to be found less in the parenchyma than in the connective tissue framework. This is most highly developed in the tendons and aponeuroses, and the pain may extend to these, so that in considering the myalgias these structures must also be taken into account. The pain of cramp, such as that of the calves of the legs, is etiologically among the most easy to understand. In this the purely mechanical factor of pressure is concerned, a form of pain mechanism that is also encountered in organs composed of unstriped muscular fibre, like the intestine and uterus. Otherwise inflammatory processes

are the most fundamental causes of myalgias, both those of endogenous nature due to disorders of metabolism and those of exogenous origin depending on toxins in general, and especially those of bacterial nature. The myalgias that are more or less physiological in nature and follow over-exertion through the accumulation of fatigue toxins may also be grouped in the class of endogenous origin. It must always be taken into account that the real cause of the myalgia may be found extramuscularly in a primary painful affection of the peripheral nervous system, such as neuritis, provided that sensory intramuscular fibres are involved; an example of this is the tenderness to pressure of the calves of the legs of drunkards.

Modifying Factors.—As has already been pointed out tenderness is an important aid in the diagnosis of myalgia. It must be ascertained whether this symptom is locally limited or is diffuse throughout the muscle and tendon. Local lesions such as traumatic or spontaneous hæmatomas, abscesses, tubercles, gummas, muscular cicatrices, echinococcus cysts, new growths, etc., frequently are characterized by local tenderness. Where the muscular inflammation is diffuse, as the result of infection or through causes of a general type, the tenderness will also be diffuse in nature. Such a condition might be due to infection with the pus-producing cocci, acute infectious polyarthritis, typhoid fever, influenza or gonorrhœa. Other processes that may be mentioned are intestinal autointoxication, Unverricht's dermatomyositis, hæmorrhagic myositis, and

parasitic diseases, especially trichinosis. In contradistinction to the neuralgias spontaneous exacerbations of pain are very rare; the symptom is caused through pressure, or active and passive motion. Of other modifying influences climatic conditions such as dampness, draughts, etc., may be mentioned, particularly in connection with myalgias localized in the muscles of the shoulder, neck, and lumbar region. If the process is situated in the muscles of respiration the movements of deep breathing, coughing, sneezing, defecation, etc., give rise to pain. The same is true of swallowing if the muscles of deglutition are involved. Of therapeutic influences mention may be made especially of the effect of salicylates and preparations of iodine and mercury.

Etiology.—Owing to the great variety of the processes giving rise to myalgias, it is difficult to arrange them in a scheme of classification. The distinction of most service in differentiation is between, on the one hand, the type running its course as a local and afebrile condition, and on the other, the type diffuse in nature and presenting the picture of a severe infectious disease.

1. Muscular Affections Chiefly Local in Nature.

Traumatic hæmatomas and hernias of muscle (the adductor group); hæmatomas following preceding vascular damage (typhoid fever, sepsis, phosphorus poisoning, arsenic poisoning, jaundice, etc.); rheumatic affections due to cold, for example, in the shoulder or lumbar aponeurosis; mus-

cular cicatrices following fibrous myositis through local venous thrombosis, for example, deep-seated varicosities in the muscles of the calves; atheroma of the muscular arteries (intermittent claudication); muscular abscesses and infarcts, gummas, tubercles, echinococcus cysts, new growths.

2. Muscular Affections Chiefly Diffuse in Nature.

1. In general infectious processes through pus organisms, acute articular rheumatism, typhoid fever, influenza, syphilis, etc., Unverricht's dermatomyositis, hæmorrhagic polymyositis, acute delirium.

2. In constitutional disorders, such as the rheumatic diathesis and ossifying myositis. The latter is unlikely after the twentieth year.

3. In parasitic diseases, particularly trichinosis.

4. Periarteritis nodosa. This is most often seen between the twentieth and thirtieth years.

Differential Diagnosis.—As has already been pointed out the diagnosis of myalgia in general is founded on the symptoms of tenderness to pressure and of increase in pain on active and passive motion. Alterations in the volume and consistency of the structures concerned have a corroborative value, but are not a *conditio sine qua non* for the diagnosis. If the symptoms mentioned are noted as well as the absence of spontaneous exacerbations the danger of confusion with neuralgia is ordinarily not very great. It is well to keep in mind the pains that are

often associated with the milder states of weakness; for example, in the shoulder girdle in cases of aortic disease, processes in the liver and spleen, or in apical tuberculosis. The connection of lesions of the kidney, such as calculus and new growths, as well as of the prostate or parametrium (metastasis of carcinoma), with pain in the thigh, also deserves consideration. Involvement of the neck muscles may simulate meningeal rigidity or spondylitis, though the contrast between the intensity of the apparent stiffness of the neck and the absence of other meningeal symptoms, and especially the tenderness of the muscles, will guard against error. Similar considerations will serve to exclude tetanus when the muscles of mastication come in question. In differentiating between pleural pain and rheumatoid affections of the thoracic muscles the chiefly, and often exclusively, axillary localization of the former seems to me to be of significance. In order to guard against mistakes it is always advisable to pay particular attention to the presence of tenderness of nerve trunks and of joints, and it should be remembered that the simultaneous occurrence of disease in these structures is not impossible.

Accompanying Manifestations.—In addition, the temperature and the general condition should receive careful scrutiny. Serious illness with typhoid-like symptoms suggests the not rarely fatal cases of Unverricht's dermatomyositis whose etiology is still uncertain, hæmorrhagic polymyositis, or in the presence of the appropriate initial intestinal symptoms,

trichinosis. In the latter case, the combination of multiple myalgia with eosinophilia is of particular importance. The presence of cutaneous œdema is also significant. It is brawny and firm, with non-involvement of the joints in Unverricht's dermato-myositis, and involves the eyelids in trichinosis. If the swelling is limited to one lower extremity, local thrombotic conditions come in question, such as those occurring in the cachexia of malignant disease or as post-infectious complications.

III. BONE PAINS OR OSTALGIAS.

The danger of misinterpreting pain caused by the irritation of sensory fibres in the bone-marrow and periosteum and of ascribing to it a different nature (rheumatic or neuralgic) is shown by experience to be no slight one. This is in part explained by its comparative rarity, and in addition there is no distinct localization in the affected part, particularly in diffuse skeletal disease, such as osteomalacia, new growths of the bone-marrow, etc. Furthermore, as far as the factor of motion is concerned, the symptoms correspond to those of many commoner and therefore better known painful conditions. For example, if the bone exhibits periosteal changes at the point of insertion of muscular masses, contractions in these will naturally be painful and there will be danger of confusion with muscle or joint pain. Spontaneous exacerbations, which may be nocturnal in character and occur, for example, in osteomalacia, new growths of the bone-marrow, and post-typhoid

osteomyelitis, may simulate neuralgic or spinal processes, and this the more so if alteration in gait, increased reflexes, etc., are present, as in osteomalacia. If one further reflects that infectious and dyscrasic factors, as well as malignant processes, play a particularly important rôle in the etiology of ostalgias, it is to be expected *a priori,* that complicating muscle, joint, and nerve pains may appear both primarily and secondarily. From this it is easy to understand that errors in diagnosis may readily occur.

Etiology.—It is advisable to begin by passing in review the various general and specific disease processes associated with bone pain.

1. Infectious processes, such as typhoid fever, influenza, sepsis, etc. The lesions of the bone-marrow in these conditions may be manifold in nature and run through all the stages from simple hyperæmia to fibrous exudation, necrosis, and the formation of specific granulation tissue such as a gumma or a tubercle. The scale of subjective pain sensations corresponds to this range of anatomical changes, running the gamut from slight pain evoked only through strong pressure to the most severe spontaneous paroxysms. Usually the primary lesions run their course in the bone-marrow itself and the periosteal involvement is secondary, although the possibility of an initial affection of the latter cannot be excluded.

The infectious process may be principally or entirely localized in the bone-marrow and give rise

to local, exceedingly intense pain (acute osteomyelitis), or the lesions may be very slight and be discovered only when special search is made for them. For example, in the course of typhoid fever and far into the convalescence it is wise not only to watch for spontaneous ostalgia (often manifesting nocturnal exacerbations), but also to look for tenderness in the portions of the skeleton frequently involved in osteomyelitis of this type. These are particularly the tibia, ribs, femur, and clavicle, and especial attention should be given to the epiphyseal regions. The bone processes due to syphilis and tuberculosis and the ostalgias associated with them fall within the province of the surgeon, and are therefore only mentioned. Tenderness pointing to irritation of the bone-marrow, particularly in the sternum, is not infrequently encountered in infectious processes like malaria and pneumonia if it is looked for, and the ostitic symptoms sometimes observed in biliary cirrhosis may also be placed in this class. Some of the cases at least, of Marie's hypertrophic osteoarthropathy, associated with clubbed fingers, may be included in the same group, in so far as they occur in empyema of the pleural cavities. The status of the disease of mother-of-pearl workers is still uncertain.

2. New growths, involving especially the bones of the trunk and of the proximal portions of the extremities. This localization is characteristic for the more or less diffuse lesions of the bony framework, such as multiple myeloma, lymphadenia ossium,

chloroma, etc., which therefore exhibit somewhat the course of an internal disease. The correct interpretation of the not uncommon pain in these conditions is an essential for the early recognition of the true state of affairs. This is no less true for the cases of metastatic new growths which are often associated with neoplasms of the breast, prostate, thyroid, and adrenal body. Given a history of the removal of a carcinoma of the breast even some years previously, the occurrence of indefinite pain always suggests the possibility of ostalgia. Paradoxical as it may sound, it is precisely the indeterminate nature of a pain that suggests the possibility of its originating in the bone.

3. Blood diseases. It is very tempting to explain the tenderness in the lower part of the sternum that is so often observed in the grave blood diseases like pernicious anæmia, myelogenous leukæmia, and pseudo-leukæmia as being associated with hyperæmic and inflammatory changes in the bone-marrow. Sometimes this symptom is one of the earliest subjective disturbances. On leaning against the edge of the table in writing, on resting against the window sill, or in bending over the washtub, the patients experience pain in the portion of the sternum pressed upon, and on examination pronounced tenderness is discovered, particularly in the lower half of the bone. An interesting observation is that the sternal pains are controlled by arsenic, and as I have convinced myself in numerous cases, are least troublesome during the acme of the drug's action. In the myeloge-

nous forms of leukæmia they may run parallel to the rise and fall in the number of leucocytes. These pains never occur spontaneously, but are always produced only by pressure over the lower half of the sternum. In exceptional cases there is also tenderness in other portions of the skeleton, like the humerus, ilium, tibia, or ribs. In such instances, in which the bone pain is widely distributed, the possibility of bone metastases must be considered. The presence or absence of sternal tenderness often gives a useful hint. For example, if the spleen is much enlarged but the sternum is wholly insensitive to pressure, the existence of myelogenous leukæmia is very improbable. On the other hand, if liver and spleen are swollen, but there is also sternal tenderness, the diagnosis of cirrhosis must be made only with great caution. It is more likely that there is some blood disease like leukæmia or pernicious anæmia.

4. Dyscrasias. Bone diseases of dyscrasic and trophic nature. For the sake of completeness reference may be made to the extremely rare condition of ostitis deformans (Paget) and of leontiasis ossea (Virchow). The pains occurring about the head in cases of the latter are probably neuralgic in origin rather than ostalgias, and are due to pressure on the nerves through the proliferation of bone.

A maid-servant, aged twenty-six years, was taken in July, 1905, with pain along the spine, extending from the first thoracic vertebra to the sacrum. The pain was persistent and increased on movement; the spine was tender to pressure. By the middle of October the symptoms had greatly increased in severity, so that the patient

could not stoop over, and in washing was obliged to steady herself with one hand. The spine was very tender, the body weight had increased ten kilogrammes! A little later the ankles became swollen, and remained so for two months. She also suffered from ocular pain, œdema of the upper eyelids, transitory diplopia, and tonic spasm of the muscles of mastication. In the summer of 1906 she noticed that her hands and feet had become very large, as well as the nose and the lower jaw. In May, 1907, she presented the typical picture of acromegaly, and at this time she complained of shooting pain in the tibiæ, which was worst at night.

This case illustrates the connection that may exist between affections of the hypophysis and bone pain.

Osteomalacia.—In this disease ostalgia appears in its purest and most concentrated form. It must always be our aim to make the correct diagnosis at a time before palpable changes in the skeleton have developed, but this is rendered possible only by familiarity with the initial pain symptoms. The lumbar region and the lower etxremities are usually indicated by the patients as the chief seats of discomfort, at least in the puerperal forms. Whenever pains having this localization appear in the course of a pregnancy, the possibility of a beginning osteomalacia should be thought of. In contradistinction to the pain due to neuralgic disorders or spinal affections, like myelitis, the pains of osteomalacia usually subside completely during rest, and their onset is intimately connected with mechanical factors. Active and passive movement, coughing, laughing, sneezing, yawning, etc., either become impossible or cause pain, even in far distant parts such as the lower extremities. Active motion, such as

walking, stooping, and rising after being seated for some time, usually causes the patients great discomfort. On getting out of bed they carefully lift out each leg in turn, holding by the thigh. Deep respiration often gives rise to pain in the ribs, and descending stairs is sometimes still more uncomfortable than the ascent owing to the jarring of the body that it occasions. While moving about is exceedingly arduous, remaining in the same position for any length of time, either sitting or lying, results in an increase of the pain, so that the patients are obliged to change their position constantly, and sleep is therefore very broken. The movement of abduction at the hip joint is particularly prone to cause paroxysms of pain, as well as rapid dorsal flexion at the ankle joint. In the latter case a pain is not rarely caused which runs the entire length of the lower extremity, radiating to the pelvis and sometimes accompanied by dorsal clonus. Lateral compression of the thorax, or of the pelvis at the level of the trochanters or the iliac crests, promptly causes pain. Wearing a corset and tight lacing sometimes appear to relieve the subjective symptoms, evidently through the support given to the spinal column.

It is clear that the mechanical factors influencing the pain of osteomalacia are not deficient in characteristic qualities. If in spite of this, confusion with other affections, particularly those of rheumatic nature, is not rare, this may partly be explained by the fact that to some extent they respond in the same

way to therapeutic measures. My experience leads me to speak of the prompt relief to pain afforded by the diaphoresis caused by hot-air baths, as well as of the improvement often spontaneously occurring during the hot summer months. Complications such as myalgias of the adductors and calves, joint pains of arthritic nature, and neuralgias like sciatica also sometimes occur and may contribute to render the picture of typical osteomalacia indistinct as regards its pain phenomena. As suggested above, accompanying symptoms like ankle clonus, together with the apparent weakness of the lower extremities, may even give rise to confusion with spinal affections. The intimate relationship between the pain of osteomalacia and mechanical factors like motion, as opposed to the more spontaneous onset of the paroxysms of spinal pain, should be sufficient for the purposes of differentiation. The absence of bladder disturbances is also an important diagnostic point. The differentiation from spondylitis in the dorsolumbar region with secondary neuralgia of the pelvis—in which I have found that there may also be tenderness of the pelvic bones owing to involvement of the periosteal nerves—is ordinarily not difficult. It is sufficient to think of this possibility in order to avoid error by a careful examination of the spinal column. Where typical bony changes already exist an extended analysis of the pain phenomena may of course be dispensed with. In its onset, however, the disease belongs to the subjective ostalgias discussed above.

Functional Ostalgias.—It may be assumed *a priori* in view of the analogous observations in the province of joint and muscle pains that ostalgias may sometimes appear as manifestations of a general neurosis, like hysteria. In fact, there are observations on record showing the possibility of the simulation of osteomalacia by that great artist in imitation, hysteria. In such cases error is to be avoided by a careful study of all the attendant symptoms, but it must be borne in mind that the existence of hysteria does not exclude osteomalacia and that the latter disease in a hysterical subject will present confusing symptoms due to this tendency.

Reflex Ostalgias.—Reflex sensitiveness to pressure and percussion over the spinal column may occur in abdominal processes without any anatomical lesion of the bone itself. This is particularly the case in gastric ulcer and cholelithiasis, in which the hyperalgetic spot is often over the twelfth dorsal vertebra at the level of the lower pulmonary border, or in the interscapular space.

I remember a case of gall-stones in which this localized tenderness was so pronounced that a very experienced surgeon made the diagnosis of spondylitis. At the autopsy the spinal column was found entirely intact.

The local tenderness to pressure and percussion sometimes exhibited by areas of the skull overlying cortical cerebral tumors may be due to slight degrees of periostitic irritation (internal erosion).

CHAPTER VII.

Digestive System.

GASTRALGIAS.

In this section those paroxysms of pain are to be described which are colicky in nature, are localized in the epigastrium, are frequently accompanied by objective gastric symptoms, such as vomiting, eructations, etc., and which in the absence of anatomical disease of the stomach are usually interpreted, and misinterpreted, as "nervous gastralgia."

General Pathogenesis.—In view of the negative nature of the condition, it is not astonishing that even the existence of gastralgia as a painful sensation arising in the stomach itself is sometimes denied, and the sensation in question is assumed to arise entirely outside of the organ in the vagus and sympathetic nerve tracts. According to this view gastralgia would be sharply differentiated from the pains occurring in other muscular hollow viscera, such as the gall-bladder, intestine, ureter, uterus, etc., and would be brought into association with the neuralgias. For the same reason that it would be improper in the case of a tumor of the Gasserian ganglion, accompanied by pain in the teeth, to speak summarily of toothache, the term gastralgia should be avoided and be supplanted by the expression sympathetic or vagus neuralgia, with the addition of the underlying cause. In analogy to the condi-

tions existing in neuralgias of the cerebrospinal nervous system the occurrence of tenderness along the nerve tracts in question, the vagus, the sympathetic nerves, and the solar plexus might be expected. It is clear, however, that owing to the topographical relations tenderness to pressure in the neck or over the anterior surface of the spinal column, in the abdomen, etc., is far from comparable in diagnostic value to the demonstration of distinct tenderness over the sciatic nerve, for example, and it is especially necessary under these circumstances not to allow the wish to become father to the observation.

Of course the occurrence of gastralgia is perfectly possible as a purely neuralgic disturbance in the course of the sensory tracts without the existence of any causative motor or secretory disorders in the organ itself. This is especially the case when the attacks of pain persist even when the stomach is empty and are not influenced by alkalies, local anæsthetics, or the ingestion of food. The gastric crises of tabes may serve as a paradigm of this group, and the similar conditions appearing in syringomyelia, multiple sclerosis, cerebrospinal syphilis, vagus lesions, etc., may also be pointed out.

Vagus Gastralgia.—For example, in a case of gastric crises under my observation, the patient was able to cut short mild attacks by inserting the finger deeply into the left external auditory meatus (vagus

fibres), but the act was accompanied by violent coughing. Starting with this observation of the patient's, to the effect that it was possible to inhibit the painful process—evidently situated in the left vagus—by a sort of counter-stimulation such as is applicable to the act of sneezing, I prescribed with good effect the application to the left auditory meatus of a pledget of cotton moistened with a mixture consisting of three drops of oil of mustard, one gram of menthol and ten grams of liquid petrolatum. I would suggest repeating this experiment in other cases of suspected vagus gastralgia.

There is no doubt that gastralgias of this sort may actually have an extragastric origin, and, as in the case just described, involve the left vagus tract. (It was not possible to influence the pain through the right ear.) Cases of this nature are comparable to those of trigeminal neuralgia in which the seat of the trouble is the Gasserian ganglion. Opposed to this small group is the large number of gastralgias in which, as is shown by the influence of modifying factors, the chief part is played by sensory, motor, or secretory processes in the stomach itself. Here the state of irritability of the nerve tracts is no longer the prime factor as it is in the gastric crises of tabes. It only furnishes the predisposition, in consequence of which various agencies acting within the stomach are enabled to produce the painful sensations. These may be either motor disturbances, *i.e.,* spasm of the pylorus either above or in conjunction with over-distention of the adjoining

portions of the stomach, or disorders of secretion and irritability of the mucous membrane. The correctness of these assumptions is shown by a consideration of the ways in which modifying agencies act, as will be discussed further on.

Accordingly, I believe that from the clinical stand-point the essential gastralgias without anatomical lesions, may simply be grouped in accordance with their susceptibility to modification through the stomach itself. Of the agencies acting in this way, diet is of course the most important. We may then distinguish: (1) Central gastralgias, that are only slightly influenced by way of the stomach, especially the diet. As the type of this group the gastric crises of tabes may be mentioned. (2) "Peripheral" gastralgias, which are markedly influenced by the diet and similar factors. It is tempting to make the grouping still more precise, and speak of forms "with" or "without" dietary modification. This would be simplification at the expense of the truth, however. For even the " central " gastralgias of tabetics may be influenced in this way, and for example, it is necessary as the attack subsides to use great caution in the administration of food not to evoke fresh seizures. Intelligent patients who observe themselves closely are able to bear witness to this. At best there are many transitions between groups 1 and 2, and the classification serves only to emphasize the two extremes.

Etiology.—The causes of gastralgia are numerous, and the following classification suggests itself.

I. Irritable Weakness of the Nervous System.

This factor is in most cases the fundamental cause of the essential gastralgias. Without the increased susceptibility to pain that it involves, no doubt many of the special factors, for example those of alimentary nature, would be inadequate to cause actual painful phenomena. In these cases the application of the therapeutic lever is particularly effective, and improvement may often be secured even in the persistence of the specific cause of the pain. The most varied influences and processes may combine to produce the condition of irritable weakness of the nervous system, mental overexertion, psychical emotions, sexual aberrations, anæmias, the arthritic diathesis, chronic infections such as tuberculosis with possible secondary sympathetic and adrenal lesions, syphilis, chronic intoxications such as nicotinism, plumbism, alcoholism, arsenic poisoning, etc. These conditions contribute their part in giving rise to essential gastralgias; they are factors that occur also in the causation of neuralgias in the cerebrospinal nervous system. Frequently they simply prepare the soil for the subsequent action of more specific causes.

II. Direct Causes.

A. Acting Centrally.—This heading comprises especially diseases of the central nervous system, such as tabes, syringomyelia, multiple sclerosis, cerebrospinal syphilis, etc. It is difficult to decide to what extent disturbances of metabolism such as the arthritic diathesis, diabetes, and the chronic infec-

tions and intoxications mentioned in the preceding paragraph, have a central or a peripheral effect. In this class may also be included the gastralgias, often accompanied by vomiting, sometimes occurring in cases of vascular lesions such as atheroma of the abdominal aorta, of the coronary arteries, the cœliac axis, etc., and concerning whose exact mechanism we are still ignorant.

B. Acting Peripherally.—Here the point of attack lies in the sensory nervous apparatus of the stomach itself. Organic lesions of the gastric mucosa, such as ulcerative or inflammatory processes, may serve to induce gastralgias, especially if there is an already existing predisposition. The actual mechanism of pain production frequently depends on a pyloric spasm of reflex nature; that is, on a pathological increase in motor activity which of course may reach its maximum when there is a permanent tendency to abnormal peristalsis, as in pyloric stenosis. Among the chemical factors—whose existence in a given case is indicated by the prompt temporary effect of the administration of alkalies—are to be counted the inorganic and organic acids, contact of which with the gastric mucous membrane may induce gastralgias of the most severe type. In view of what was said above under section I., it may be expected that in hyperæsthesia small amounts of acid will be effective, while the variety of the acid is also not without importance.

Acidity.—The complaints usually ascribed to hyperacidity and capable of being modified by the administration of alkali might therefore more cor-

rectly be spoken of as due simply to acidity, since frequently they result not from an excess of acid but through an increased susceptibility to acids. Here again those gastralgias might be mentioned that sometimes occur with an anatomically intact stomach after the ingestion of strongly acid foods or those forming acid on decomposition (animal fats, milk) or strong spices, coffee, etc. Mechanical factors, such as insufficient mastication, overeating, and foods tending to gas formation, also come in question. Various idiosyncrasies also may come into play, such as an intolerance of egg albumen, ingestion of which induces the severest pain in some individuals.

Hunger Pain.—Just as quantitative and qualitative abnormalities in the ingestion of food, including poisoning, may lead to gastralgiform attacks, protracted fasting may have a similar effect. This appears rather paradoxical, since apparently nothing becomes a cause. In reality it is probably the physiological increase in peristalsis (growling of the empty stomach) that accompanies the sensation of hunger, and sometimes perhaps also the gastric juice secreted under these conditions that causes the pain, and this is particularly likely to occur if the predisposition already spoken of in section I. exists or the stomach has become a *locus minoris resistentiæ* through ulcerative processes (particularly ulcer, rarely carcinoma). I have observed this hunger pain also in cases of achylia and such instances prove that the presence of hydrochloric acid is not an indispensable element in its production.

III. Reflex Causes.

The gastralgias comprised under this heading include those sometimes occurring in diseases of the appendix, disorders of the female genital apparatus, sometimes even in nasal affections, hernias of the omentum in the linea alba, movable kidney, etc. In such cases it is always necessary to determine whether factors from groups I. and II. are not also concerned, and accordingly one-sided special treatment must be avoided. I consider it very probable that the epigastric pains often accompanied by gastric symptoms such as vomiting, eructations, the feeling of peristaltic unrest, etc., which sometimes occur in cases of more or less latent gall-bladder disease as well as in pancreatic conditions and diseases of the aorta and coronary arteries, are, as a matter of fact, to be regarded as reflex gastralgias.

Differential Diagnosis.—Colicky pains in the epigastrium associated with gastric symptoms of course always suggest gastralgia, but a satisfactory diagnosis can be made only through the proper interpretation of the causative factors. For this purpose it is necessary to pass in review the possibilities suggested under headings I., II., and III., unless definite peculiarities of the pain give the necessary clue.

Topography and Time.—Attention may be called to the purely left-sided character of the pain that is sometimes observed. Biliary colic is never restricted to the left half of the epigastrium—leaving out of account the possibility of transposition of the viscera. As a rule, left-sided pain is observed

oftener in ulcer, carcinoma, and other organic diseases of the stomach than in primary gastralgia, though there are exceptions to this.

In a case of achylia gastrica accompanied by pain in a neuropathic tuberculous patient there was tenderness of the epigastrium on the left side. More careful examination revealed that the whole left side of the body was hyperæsthetic!

It is therefore possible to have even a primary gastralgia accompanied by left-sided tenderness in this roundabout way. Primary gastralgias ordinarily do not radiate into the upper extremities, particularly not—as opposed to cholelithiasis—into the right shoulder and arm. Radiation into the left upper extremity is also very rare as compared to the epigastric form of angina pectoris. For a consideration of the tendency to radiation exhibited in the colic of pyloric stenosis reference may be made to the section in question. It is also advisable to try to ascertain the depth of the pain from the surface in order to avoid erroneously interpreting intercostal neuralgias in the epigastrium as gastralgias. For this reason it is always wise to test the cutaneous sensibility of the epigastrium. This is also advisable in order not to overlook possible gastric crises, in which girdle-like zones of sensory disturbance are very common. Onset of the pain immediately after eating is more frequent in essential gastralgia than in ulcer. Recurrence of the pain at definite intervals, sometimes of weeks, is of interest and suggests a disorder of functional nature.

A young lady from Belgrade suffered from attacks of vomiting and severe gastric pain appearing every other day in the forenoon.

I saw the patient in her fifth attack. Examination of the blood showed the presence of the parasites of tertian malaria.

With regularly intermittent attacks of gastric pain the possibility of malaria should never be lost sight of. The regular daily recurrence of the attacks, particularly if a relationship to the taking of food can be demonstrated, suggests the possibility of the conditions discussed in group II. B, such as ulcer, pyloric stenosis, etc. On the other hand, great irregularity in the appearance of the pain points more to the central diseases spoken of under group II. A, and perhaps the reflex factors of group III.

Modifying Factors.—In order to avoid errors in drawing conclusions from the causative factors, it is always necessary to remember that these are occasionally multiple in nature.

Not without reason was the group included under the heading of irritable weakness placed first in the list of etiological factors, for gastralgias of the most varied origin may be founded on this basis. This indeed is true of attacks of pain in general, and the occurrence of a gastralgia under the influence of emotional excitement, such as anger or grief, is far from justifying the exclusion of an organic cause. Among the mechanical factors I should attach a not unimportant rôle to the matter of bodily position. If the gastralgia is merely the result of functional or organic disease of the nervous system the effect of position will in most instances be hardly perceptible. The reverse may be the case to a very pronounced degree, however, if organic lesions of

the stomach (II. B) or reflex stimuli from abnormally movable organs (III.) are concerned. Unfortunately there are exceptions to this rule which somewhat restrict its applicability, though not invalidating it.

An officer suffered for some years from frequently repeated attacks of "cramps in the stomach." Color good, somewhat florid. Formerly he smoked more than 100 cigarettes daily, but later reduced the number to 30. The pain comes on after eating and lasts for an hour or two. When riding a good deal or taking exercise, as in hunting, he feels perfectly well and can eat anything. Excitement frequently causes right-sided headache. During the gastric attacks there is a sensation of heat at the back of the head and belching of gas, but no heartburn.

In this typical case of essential gastralgia due to excessive smoking the patient affirmed that lying on the right side increased his discomfort and that he had the feeling of the gastric contents passing over to that side. If gastralgic seizures occur in connection with rapid motion, stair-climbing, etc., masked forms of angina pectoris must always be thought of. Exercise such as riding or mountain climbing acts favorably in some cases of essential gastralgia, especially those associated with the uric acid diathesis, and this may aid in the differentiation from ulcer. Pronounced tenderness, particularly on percussion of the epigastrium or on pressure, renders the existence of an organic condition likely, especially if asymmetrical, but exceptions in this regard may be encountered both on the organic and on the functional side. Massage or firm pressure sometimes relieves the pain in functional gastralgia.

Particular attention must of course be given to the effect of diet. The mechanical, chemical, and thermic factors concerned in the ingestion of food tending to gas formation, strongly acid, spiced, or fatty foods, cold fluids, etc., are of importance, especially in dealing with the organic processes spoken of under group II. B. It would be wrong to assume, however, that the diet is a negligible factor in the functional gastralgias. In those suffering from this predisposition there is a state of gastric weakness in consequence of which the tolerance of the stomach is much impaired. Two points must be emphasized in this connection. In the first place the tolerance for food is often restricted irregularly, for example coffee is sometimes very badly borne. This symptom must never be overlooked, it is almost the stigma of the gastric neuropath. Secondly, the degree of tolerance is subject to wide and rapid variations. In every case it should be investigated, not only through the patient's statements, but also experimentally. One often sees gastric neuropaths who have long been kept on a strict ulcer diet, and in whom a liberal taxing of the tolerance is not only diagnostically useful but also an effective mode of treatment.

The effect of acids and the opposite test with alkalies is also of importance. Small doses of sodium bicarbonate are often beneficial in cases of essential gastralgia even if, as I have often seen, hydrochloric acid is absent. The explanation seems to lie in the stimulus to the over-distended stomach causing it to expel the accumulated gas. In a simi-

lar way a swallow of cold water or a few drops of brandy sometimes have an anodyne effect.

An anæmic, nervous lady, who had previously suffered from chlorosis, had for some time suffered from sudden attacks of epigastric pain, occurring especially after excitement. She had the feeling as if a stick were being pushed through the mouth into the stomach. The attacks lasted for twenty minutes to two hours and the patient would then fall asleep. There was also a painful point at the top of the head, which was very sensitive to the contact of the comb. The first attack came after taking cold beer. The dietetic tolerance was not restricted. The administration of sodium bicarbonate relieved the pain, as did also belching of gas.

In the same way it seems to me that the action of local anæsthetics, such as cocaine and anæsthesin, is of importance from the diagnostic standpoint. If the administration of such agents causes rapid decrease in the discomfort the presence of local pain-producing factors, such as ulcer, carcinoma, hemorrhagic erosion, or hyperæsthesia of the gastric mucosa, may be regarded as demonstrated, and in making the otherwise difficult decision between gastric and duodenal ulcer the prompt production of relief in this way points in favor of the former lesion. The purely nervous origin of some forms of gastric pain explains the prompt effect sometimes seen on the administration of antineuralgics such as antipyrin. This point is of diagnostic value, though it is only the promptness of the action that is significant, for organic visceral pain, like that of cholelithiasis is also susceptible to the effect of these drugs.

A possible interdependence between the onset of gastric pain and constipation of long duration should

not be overlooked. In hydrochloric acid hyperæsthesia or hyperacidity, as well as in ulcer and pyloric stenosis, there is no doubt in regard to a connection of this sort, and it probably depends on interference with the emptying of the stomach and secondary stagnation and fermentation of its contents. The effect of menstruation and pregnancy should also be considered.

Accompanying Manifestations.—Although in cases of gastralgia the best advice that can be given is to make a complete physical examination involving all the organ systems, in addition to the analytical study of the paroxysms in the manner just indicated and keeping in mind the possibilities suggested in the introductory classification, it may be helpful to emphasize several points that aid in rapid orientation, although not of great importance *per se*. Chief among these is the examination of the stools for occult blood. If found repeatedly this may establish the diagnosis of ulcer or carcinoma. The coincidence of pain in the stomach, vesical disturbance, a girdle of sensory disorders at the level of the epigastrium, and pain in the lower extremities suggests tabes. The syndrome gastralgia and distended bladder always awakens suspicion of gastric crises. High blood-pressure, accompanied by arteriosclerotic pallor of the face and dyspnœa, even though slight, suggests an arterial starting point such as angina pectoris. Gastralgia with sarcinæ in the vomitus or in the feces points to ulcerative stenosis of the pylorus. The same thing is true of visible gastric peristalsis or marked gastric meteor-

ism (not to be confounded with distention of the epigastrium through an enlarged liver in cholelithiasis). Examination for a palpable or painful gall-bladder, for the presence of a hernia in the linea alba, or for tenderness of the appendix and parametrium, should never be omitted. Diarrhœa is associated oftenest with achylia and gastric crises. Herpes labialis suggests the possibility of infectious processes, in the gall-bladder or appendix for example. Associated headache makes an essential gastralgia more likely than ulcer. It may precede, accompany, or follow the gastric pain. Cases are often seen in which the patients state that they suffered for a long period from headaches, which then ceased and were replaced by attacks of pain in the stomach. One sometimes gains the impression that there is actually a sort of vicarious relationship between the two. Important symptoms in essential gastralgia are globus, sometimes followed by hoarseness, and clavus hystericus, and these should always be enquired for.

GASTRIC ULCER.

Topographical Considerations.—It might be assumed *a priori* that in ulcerative processes of the gastric mucosa the pain, whether spontaneous or produced artificially through pressure or percussion, would have a more or less asymmetrical left-sided localization corresponding to the position of the organ. As a matter of fact, this is true in a large number of cases, at least so far as ulcers in the neighborhood of the cardia or the central part of the

stomach are concerned, and may be made use of in differential diagnosis. Exclusively or principally left-sided spontaneous pain or tenderness to pressure, either in the epigastrium or in the anterior or posterior lower thoracic region, renders painful processes of the right side of the abdomen and particularly gall-bladder affections improbable, and therefore limits the diagnostic possibilities from the very beginning.

The painful area to be outlined by pressure or percussion is not rarely situated on the left side anteriorly, just below the costal arch, somewhat to the median side of the mammary line. It is also sometimes possible to discover another point of tenderness on the left side posteriorly, close to the vertebral column, at about the level of the twelfth dorsal or first lumbar vertebra. Concussion of the left lower portion of the thorax with the fist at about the level of the lower pulmonary border is also often exquisitely painful as compared with the right side. Even when the pain is median in onset it frequently radiates in the direction of the left costal border and to the left scapula. This is particularly likely in cases with perigastritic adhesions to the diaphragm, the transmission probably taking place through the phrenic nerve into the shoulder. There may then also be a pressure point over the outer and middle third of the upper border of the trapezius muscle. While the left-sided position of the pain is not pathognomonic of gastric ulcer its diagnostic significance is the result of the position of the organ in the abdominal cavity and cannot be neglected.

Sometimes, in exceptional cases, the pain may involve the left side of the thorax.

I remember one patient with undoubted ulcer who felt pain below the left nipple on raising a weight, and another who on coughing had pain on the left side in the neighborhood of the third rib in front and in the corresponding region posteriorly.

The great frequency with which the smaller median and right-sided prepyloric and pyloric portion of the organ is the seat of ulcerative lesions causes the pain to occupy a similar position in a great proportion of the cases. Not only is the spontaneous pain experienced in the middle portions of the epigastrium, but on testing the sensibility by percussion the maximum point of tenderness is frequently found on a line connecting the xiphoid process with the umbilicus. I must caution, however, against drawing conclusions in regard to the site of the ulcer from this position of the area that is painful on percussion. It is easy to convince oneself, for example, that in cases of hepatic congestion in which the hypersensitiveness of the organ to mechanical insult is no doubt the same throughout, percussion is always most painful in the midline of the epigastrium, while on the right and left sides it may cause little or no discomfort. This may be explained as follows: On either side of the midline the recti blunt the force of the blow through their contraction, but in the center, where, especially in cases of ulcer, diastasis of the recti may exist together with enteroptosis, this *défense musculaire* is wanting and the impact is received unaltered by the stomach.

This is apt to be overdistended with gas and the increased tension may result in pain production quite independently of the actual position of the ulcer. In most cases the lesion appears to be near the pylorus on the lesser curvature. The tenderness to percussion frequently begins about four finger breadths below the xiphoid process and extends to the neighborhood of the umbilicus. If it begins immediately below the xiphoid and corresponds to an area of dulness, the possibility of hyperalgesia of the liver, perhaps through congestion, or following an attack of gall-stones, must be seriously considered. It must also be remembered that hepatic congestion and ulcer may occur coincidently and that the development of an ulcer may be favored by the vascular and circulatory disturbances. Therefore in cases of myocardial degeneration, mitral stenosis, etc., with painful congestion of the liver and accompanied by symptoms suggesting gastric ulcer, the relations of the tender area to the liver edge should be carefully studied. If it is situated below this the possibility of ulcer must always be thought of. An unusual location of the pain is over the lower portion of the sternum.

A tinsmith, aged forty-two years, began two years ago to have pain in the abdomen and the feeling "as if he had a heavy stone there." There was loss of appetite and even at that time black, glistening stools. Three months later a burning sensation over the lower part of the sternum, extending laterally along the ribs. The pain began at nine in the morning, two hours after breakfast, and lasted till noon. It ceased after taking soup, and then appeared again in the afternoon from three to six o'clock. In walking he had to take care to avoid a misstep. Lying on the left side gave relief. Only the lower part of the sternum was tender on percussion.

Just as spontaneous pain and tenderness to percussion or pressure may occur in the midline anteriorly, symmetrical backache or hyperalgesia of one or more thoracic or lumbar vertebræ (usually the twelfth dorsal or first lumbar) may sometimes be encountered.

A professional hunter, aged twenty-six years, in March, 1900, vomited black clotted blood and had bloody diarrhœal stools, accompanied by vertigo and ringing ears. The following day he fainted and was brought to the hospital with only 20 per cent. of hæmoglobin. The epigastrium was not at all sensitive to pressure, but there was great tenderness over the fourth dorsal vertebra.

Ulceration of the pylorus itself not rarely causes exquisite tenderness on the right side, which may be either just to the right and above the umbilicus or nearer to the costal border and therefore in unpleasant proximity to the gall-bladder. The radiation of the pain of pyloric ulcer is less intimately associated with the ulcer as such than with the pyloric stenosis, and will therefore be discussed with the subject of colic due to this condition. At present only the retrosternal radiation sometimes observed in ulcers of the lesser curvature will be mentioned. Ordinarily only the lower part of the sternum is involved, but sometimes the sensation extends upward toward the neck, and when it is accompanied by the sense of oppression and is dependent on motion (traction), confusion with angina pectoris may result.

The pain of ulcer is nocturnal in a considerable proportion of cases, the paroxysms frequently occurring during the midnight hours (from 11 to 1 o'clock)

and lasting into the early morning. The relation between the ingestion of food and the onset of pain varies greatly from case to case, and I should never venture from this to draw conclusions in regard to the localization of the ulcerative process. Often the pain begins immediately after eating, but sometimes it does not occur until hours after the last meal. In pyloric ulcer, particularly if there is also stenosis, there is more regularity in this regard and the pain customarily begins two or three hours after the midday meal, as will be explained at greater length in discussing the subject of pyloric colic.

The Nature and Pathogenesis of the Pain.—The nature of the pain is very variable. Sometimes the feeling of a "sore spot" is complained of; frequently there is simply a diffuse sense of pressure in the epigastrium, a sensation of heaviness "as if there were a stone in the stomach." Sometimes it is described as being cutting, piercing, burning, or gnawing, or it may be spasmodic or throbbing in character. The intensity of the pain, and especially also the tenderness, may vary in a short time between wide limits so that while at one moment even deep pressure may not be painful, a few hours later even the contact of the shirt may seem unbearable. It is evident that the ulcerative process itself undergoes no change within so short a lapse of time, but gastric distention may develop, and I think that this accounts for the rapid fluctuations so often encountered. The more the ulcerated gastric wall is stretched by gas formation the greater will be the

tenderness to pressure and percussion. Before beginning to discuss the actual causation of the pain, it may be well to say a few words in regard to its pathology. It is evident that the conditions are rather more complex than in ulcerations of the buccal cavity, for example, for here we have an organ whose wall may sometimes be abnormally distended through the accumulation of gas, and which, on the other hand, is subject to spasmodic contraction. Furthermore, one must take into account its peritoneal covering, which may become inflamed over the ulcerated area (perigastritis), and also the production of acid gastric juice which may serve as a source of irritation. Every one of these factors, and of course to a much greater degree their combination, may occasion pain.

At this point I should like to touch briefly upon the question as to why the deep ulcerations of the gastric mucous membrane caused by carcinoma rarely give rise to painful seizures similar to those of the benign simple ulcer. The acidity of the carcinomatous stomach is also often high owing to the formation of organic acids, such as lactic, acetic, and butyric. In the explanation of this apparent paradox two factors play a large part. (1) The carcinomatous stomach is much less prone to spastic contraction than is the stomach with simple ulcer. The latter in spite of the frequently existing moderate degree of motor insufficiency is still undoubtedly in a state of motor hyperexcitability (irritable weakness), and every spasmodic contraction of the ulcer-

ated gastric wall may serve to cause pain. (2) In ulcer the stomach is more liable to meteorism, especially if there coëxists pyloric stenosis, either functional through spasm, or organic through cicatricial contraction. The resulting tension of the wall of the organ is a very active source of pain. At any rate the two mechanical factors of contraction and overdistention play an exceedingly important part in the pathogenesis of the pain of ulcer.

Not rarely psychical factors, such as excitement or anger, are adduced by the patients as initiating the attacks of pain. If one takes into consideration the interdependence between the emotional state and the motor and secretory functions of the stomach, and on the other hand, the fact that the intensity of stimulus necessary to evoke pain in an emotionally excited person is reduced, the demonstration of such a relationship will probably never be regarded as by itself sufficient reason for assuming the existence of a functional disorder. It is especially necessary to be on one's guard since gastric ulcer is not rarely associated with the neuropathic constitution and a tendency to enteroptosis.

The mechanical factors in the process of pain production are of the greatest differential value in dealing with the pain of ulcer as opposed to that of other gastralgias, such as those occurring in organic or functional nervous disorders like tabes or neurasthenia, or those due to secretory anomalies or to intoxications (lead, nicotine). It is clear from what has been said above that the way in which mechanical

factors act will not be uniform and that the position of the ulcer and any existing adhesions will be of importance. A peculiarity frequently observed in cases of ulcer is that during the paroxysms, and sometimes also at other periods, the position of the patient while in the horizontal posture, whether on the face, back, or side has an undoubted effect on the intensity of the pain. It may at once be pointed out that similar observations may be made in painful affections of other organs, such as the liver, kidney, appendix, etc. I do not therefore agree with the generally accepted explanation that in certain positions the eroded surface is exposed to the impact, so to speak, of the gastric contents, while in others this is not the case. Assuming that the material in the stomach is pultaceous and therefore not easily movable, as must often be the case, this explanation seems somewhat forced. At the most, it could be claimed only that the weight of the overlying layer, which, however, cannot vary very greatly, may have a pain-increasing effect, though this seems to me rather improbable. I should regard it as much more natural that, just as in the case of other painful abdominal organs, displacement, traction, or kinking at the pylorus takes place and increases the pain. When the stomach is full it is particularly liable to displacement of this sort as a whole and in part, and this can hardly be without effect in the presence of the inflammatory adhesions usually existing. Such displacement in different positions of the body is the more likely to occur in

ulcer since not rarely the condition is associated with enteroptosis and lax abdominal walls. This imperfect fixation of the abdominal organs as a whole is further contributed to by the considerable reduction in intra-abdominal padding due to the absorption of fat commonly seen in cases of ulcer. Therefore I should consider the effect of the painful position as due less to a displacement of the gastric contents than to that of the stomach itself (*cf.* page 24). The patients themselves often complain, for example, that when lying on the left side "a weight seems to pass to the left." The pain accompanying the lateral position is sometimes experienced on the same side, but may also be contralateral, so that when lying on the right side it is felt to the left of the epigastrium, and often conveys the impression of traction to the right. The painful position may be noted only during the spontaneous paroxysms and frequently appears to depend on overfilling of the organ, which, of course, would predispose to displacement. It does not seem to me justifiable to draw conclusions, as is often done, in regard to the localization of the ulcer from the relations between the position of the body and increase or decrease in pain, since the connection evidently does not depend on simple displacement of the gastric contents due to gravity alone. A fairly constant though not invariable rule is that painful lesions of the pylorus, particularly if accompanied by stenosis, make the right lateral position uncomfortable during the spontaneous attacks of pain, but more will be said on this subject in discussing the pain of pyloric stenosis.

So far only the horizontal position has been considered. In walking, the body is frequently held inclined forward, at least at the time of the paroxysm. Relief is sometimes afforded in the sitting or crouching position, but in other cases these attitudes increase the patient's discomfort. Pain in the back, either bilateral or only on the left side, is sometimes complained of. Movement, as in walking, may bring on pain and therefore rest in bed is often the most important factor in the treatment of ulcer. A misstep, or exertion while stooping, calling into play the abdominal muscles, as in lifting heavy loads, is a frequent cause of pain, and may bring on a hemorrhage. I recall an instance in which a patient after lifting a heavy load experienced for the first time a burning sensation below the left breast, which was followed by the development of typical ulcer symptoms. Violent straining at stool may act in the same way.

The respiratory movements may also cause pain, usually on the left side of the epigastrium just below the costal border, particularly if perigastritic complications are present. In these cases the sensation may radiate from the epigastrium to the left along the axillary portions of the thorax into the shoulder. Such a relationship of the pain to respiratory movements is a significant factor in the differential diagnosis between ulcer and essential gastralgia. It is hardly necessary to indicate that efforts such as those of coughing and sneezing may also be painful. Under these conditions the sensation may be

located in the thorax. Straining at stool sometimes causes pain in the pyloric region, and in one case of mine about the sternal end of the third rib. The dependence of the pain of ulcer on mechanical stimuli, such as pressure and percussion, is among its most useful diagnostic peculiarities, but the impression appears to obtain that, as in the case of an ulcer in the mouth, the sensitive area corresponds to the anatomical lesion and depends on this alone. Pain on pressure and on percussion are, however, undoubtedly dependent on the degree of tension of the stomach wall. If the organ is greatly dilated, as may occur without true cicatricial pyloric stenosis through pyloric spasm and secondary stagnation, pressure and percussion will be particularly painful. This will be the case over a considerable area, and even when the trauma does not correspond to the situation of the diseased spot. This view is further borne out by the enormous fluctuations in sensitiveness often occurring within a few hours and running parallel to the degree of distention of the organ. The possibility of determining the position and size of the ulcer by outlining the painful area by percussion seems to me to exist only when the stomach is not distended. The percussion must be very gentle, as if forcible it acts as a strong vibration, such as that caused by coughing, for example. Tenderness to percussion over the epigastrium should be looked for in the following situations: (1) From the xiphoid process to the umbilicus. (2) In the apex of the angle on each side between the outer border of the

rectus and the costal arch. (3) At a point about 2 cm. to the right of and above the umbilicus. (4) The lower part of the sternum. In the back hyperalgetic areas are not rarely found in the neighborhood of the spinal column, particularly between the shoulder blades in the neighborhood of the twelfth dorsal vertebra. The left flank may also be sensitive to percussion with the clenched fist, less rarely the right, in contradistinction to cholelithiasis. In rare cases the epigastrium, and still more rarely the dorsal regions just indicated are so hyperalgetic that simple contact and slight pressure (the weight of the bed-clothes, for example) are sufficient to cause pain. Overdistention of the stomach through diagnostic inflation (caution is necessary) may give rise to acute spontaneous pain and tenderness to pressure.

So far we have discussed factors concerning whose purely mechanical nature there can be no doubt. The effect of diet presents a much more difficult problem. Here one is dealing with a complex of mechanical, chemical, and thermic factors, and this may explain the great variability in the effects of dietary regulation, although certain underlying principles always stand out clearly from the chaos of inconsistencies. The mere fact that the pain is subject to alimentary modification at all seems to me of greater diagnostic importance than the exact manner and nature of the effect produced. The pain-inducing factor may be regarded as purely mechanical when it is the result of the use of foods causing gas formation. Here, as has already been

pointed out several times, it is the gastric meteorism —which is predisposed to by the atony of the ulcerated stomach and its tendency to pyloric spasm— that produces the paroxysms of pain through tension of the walls of the organ. This explains the prompt relief that often follows vomiting or the evacuation of gas, and the beneficial effect of the local application of an ice bag. Some foods (*e.g.*, pork) may have a purely mechanically irritating effect through their indigestibility and act as foreign bodies. Acid foods and strong spices, including salt and pepper, are nearly always badly borne. Of beverages, hot tea with milk, and milk to which an alkali like lime water or vichy water has been added, seem to agree the best. Coffee, beer, wine, and cold water often induce paroxysms of pain. Sometimes coffee, whiskey, or carminatives may bring relief to the pain, possibly through hastening the emptying of the stomach which is often overdistended with gas.

One patient of mine found that hot water with a little brandy was most effective in relieving his pain.

Meat sometimes also has a favorable effect which is ordinarily explained as due to the neutralization of the excess of hydrochloric acid. For my part, as the result of numerous observations, I consider that hydrochloric hyperacidity is very far from frequent in ulcer and have furthermore been able to convince myself that in undoubted cases of the lesion even large doses of dilute hydrochloric acid have not increased the pain and have sometimes even seemed to have a favorable effect, possibly through an antifermentative action. I should always advise testing

the effect of acid and alkalies experimentally in cases of gastric ulcer. If the administration of alkalies relieves the pain the proof of hyperchlorhydria has not been furnished, for there may exist what I think is rather frequent, namely, a hyperæsthesia to hydrochloric acid accompanied by even subnormal HCl values. In addition, the discharge of gas and consequent reduction of gastric meteorism sometimes produced must be taken into consideration. That the ingestion of meat and milk frequently does not act exclusively through the neutralization of hydrochloric acid is shown by the fact that not rarely a piece of bread will have the same effect.

Increased peristalsis is likely to attend the sensation of hunger caused by prolonged abstinence from food. This is evidenced under physiological conditions by the "growling of the stomach," and the ingestion of food of any sort appears to have a quieting effect on the spasmodically increased motor activity. Hunger not infrequently causes pain to appear in ulcer. Similarly, the effect of tobacco in causing pain, not only in essential gastralgias but also in ulcer, may be due to the increased peristalsis.

It is not possible to formulate distinct rules in regard to the effect of thermic stimuli on the pain of ulcer. In most cases moderate warmth, both internally through beverages such as warm milk or tea, as also externally by means of fomentations or hot water bottles, appears to act favorably on the pain, but cold (a swallow of cold water, or an ice bag to the epigastrium) not infrequently relieves in

cases in which heat increases the discomfort of the patient.

Among the interrelationships between the pain of ulcer and the condition of other organs or their functions, constipation, which is so frequently seen in this disease, appears to me to be of importance particularly from the therapeutic standpoint. Constipation is undoubtedly a pain-producing factor, for when it has persisted for any length of time the intensity and frequency of the attacks nearly always increase, only to subside again after evacuation of the intestine. Occasional enemas of oil or glycerine and possibly the regular administration of mild laxatives, such as cascara sagrada, are therefore urgently indicated. It appears most likely that the blocking of the fecal masses reacts upon the stomach and causes stagnation in this organ, thus increasing the tendency to meteorism. The effect of the latter upon the pain of ulcer has already been discussed at length. It is hardly necessary to point out that a condition of "irritable weakness" of the nervous system is unfavorable, particularly if accompanied by anæmia, and therapeutic measures must be directed along these lines. No less undesirable is the effect of enteroptosis, which is not infrequently encountered in neuropathic individuals. If gastroptosis exists, the resulting kinking at the pylorus leads to stagnation and abnormal fermentation of the gastric content, while at the same time painful traction on the organ is also likely to be caused. Accordingly, in such cases an abdominal binder should be applied. When pregnancy has a beneficial

effect on ulcer and its pain, as was the case in some instances that I recall, it is possible that among other factors the relief to the condition of enteroptosis produced by the elevation of the abdominal viscera through the enlarging uterus is of importance.

Accompanying Symptoms.—Among the symptoms associated with exacerbations of pain the most characteristic are those standing in close relationship to the mechanism of pain production. For example, the distention of the stomach is often evident from the presence of a rounded swelling, or at least an air-cushion-like resistance, in the left (as contrasted with cholelithiasis) side of the abdomen. Pressure over this sometimes occasions pyrosis through regurgitation upward, sometimes there is distinct, easily produced succussion.* Frequently there is audible and palpable gurgling owing to the increased peristalsis, or there may be acid eructation or belching of gas smelling like putrid eggs (SH_2) and vomiting followed by the immediate cessation of the pain (as opposed to cholelithiasis). Chills occur only rarely and then in neuropathic persons with abnormal vasomotor excitability; the superficial abdominal reflex is sometimes increased on the left side, headache and attacks of vertigo are often seen, as well as the feeling of great heat and sweating, especially during a hæmorrhage. Microscopically the examination of the vomitus or of the feces

*In cases of gastric ulcer it is desirable, in order to avoid local injury in testing for splashing in the stomach, to shake the whole abdomen by grasping the two sides of the pelvis with both hands.

may reveal the presence of sarcinæ, which is a finding of importance. As noted above, I do not regard hyperchlorhydria as a frequent concomitant of ulcer.*

Differential Diagnosis.—In distinguishing the paroxysms of gastric ulcer from those of the gastralgias of "nervous" nature, such as may be caused by organic lesions of the nervous system, tabes, multiple sclerosis, syphilis, etc., and which are often dependent on a neuropathic basis, as in hysteria, exophthalmic goiter or nicotinism, the intermittent character of the pain in the latter may be emphasized. In these conditions, in addition to the sporadic nature of the attacks and the lack of susceptibility to influence by mechanical factors, such as position, motion, or pressure, there is also the absence of permanent or consistent modification through diet. In difficult cases it is advisable to make careful dietetic observations in order to determine the degree of tolerance for articles of food badly borne in ulcer. The lack of response to dietary changes will also prevent confusion in cases of epigastric intercostal neuralgia. As opposed to the more occasional attacks of gall-bladder colic, the pain of ulcer is characterized by greater persistence and the action of local anæsthetics is of importance (*cf.* pyloric stenosis colic). The existence of a hernia of the linea alba, which may exhibit the same epigastric tenderness as ulcer, is easily recognized

* Local conditions, the diet for example, may be of significance in this connection, and my experience relates to patients as seen in Vienna.

by palpation while the patient coughs. Still, even after the discovery of a hernia the possibility of the simultaneous occurrence of both conditions must be kept in mind. The epigastric tenderness sometimes seen in chronic bronchitis as a muscular phenomenon involving the insertions of the recti and comparable to the pain in the calves after fatiguing marches, is likely to lead to error only if the examination is superficial and gastric symptoms happen to coëxist, as in tuberculosis.

Hepatic congestion with tenderness seems to offer a possibility of mistakes in diagnosis. In cases of ulcer, associated with cardiac insufficiency and hepatic congestion—in which the gastric lesion may be predisposed to by the circulatory disorders—the epigastric pain is likely to be ascribed summarily to the hepatic condition, and the stomach symptoms are explained in the same way. It may be that not until perforative peritonitis intervenes, as in a case I have seen, is the true state of affairs recognized. It is important to demonstrate that there is also a spot painful to percussion *below* the edge of the liver and that the pain does not subside under digitalis as is the case in the hepatic condition. Of course, careful study of the attendant circumstances is also necessary. Angina pectoris, especially in its graver forms induced through lesions of the aorta and coronary arteries, may simulate the symptoms of ulcer if the pain is localized in the epigastrium and evidence of gastric disturbance like vomiting is present. This is the more likely to be the case if the epigas-

trium is tender to pressure, as the result of inflammatory atheroma of the abdominal aorta. In dealing with persons over forty, of stocky build and pale complexion, with a tendency to dyspnœa, thick arteries, and high blood pressure, one should always be slow to make the diagnosis of ulcer, particularly if it is found that rapid motion, stair climbing, etc., give rise to the epigastric pain. The characteristic anguished facies of the patients during the attack also gives a hint as to the true state of affairs. If the dietary has no particular effect on the pain, as is usually the case, the distinction is not difficult to draw. The conditions are more difficult when the ingestion of food also induces attacks in coronary or aortic angina. In such cases the nature of the food is frequently without significance; for example, in one case the attacks occurred no matter whether the patient took milk or pork and sauerkraut; it was the ingestion of food as such irrespective of its quality that caused the pain. Those cases should also be borne in mind in which gastric ulcer affords the reflex starting point of hysterical angina pectoris, particularly if aortic lesions are present, such as aortic insufficiency. Neuroses are most apt to occur in anatomically damaged organs.

In all cases of suspected ulcer the region of the appendix should be examined for tenderness. Just as appendicular colic not rarely begins in the epigastrium, chronic appendicitis may be associated with epigastric symptoms simulating ulcer. The possible combination of both conditions must also be consid-

ered. In cases of achylia gastrica, such as occur independently or as part of the picture of a pernicious anæmia, ulcer-like symptoms, sometimes even associated with the apparent symptoms of hyperacidity, may occur. The demonstration of the absence of hydrochloric acid will give the necessary clue. The same thing is true of gastric carcinoma, which sometimes begins with typical ulcer symptoms. In chronic gastritis tenderness over the pylorus may be present, though this is usually slight. There may also be similar dietary symptoms, though seizures of severe pain are almost never observed. The possibility of ulceration in other portions of the gastro-intestinal canal must also be taken into account. These exhibit similar and therefore confusing dietary symptoms. I believe that it is impossible to distinguish with any degree of certainty between the pain of gastric and of duodenal ulcer. The application of the anæsthesin test has already been described (*cf.* page 42). If the pain of intestinal ulceration, for example, of tuberculous nature, is accompanied by symptoms such as vomiting, gastric splashing, etc., and is localized in the epigastrium, it is very difficult to make the distinction, particularly in view of the similar behavior of the two affections in regard to the ingestion of food. The case is rendered still more complex if, as in an instance observed by me, intestinal symptoms such as diarrhœa and increased peristalsis are absent. Under these conditions the appearance of pain in the lower abdomen, as well as of tenderness in the ileocæcal region,

seems to me of great importance. At any rate, great caution is necessary in making the diagnosis in patients having pulmonary tuberculosis.

THE COLIC OF PYLORIC STENOSIS.

Just as stenosis of the intestine may give rise to attacks of colic more or less independently of the nature of the obstruction, paroxysms of similar etiology are occasioned when the pylorus is narrowed. As is the case in the intestinal canal, internal stenoses induced by lesions of the mucosa produce the most intense attacks of pain. Fresh pyloric ulcerations are not necessary for this; it is rather chronic cicatricial inflammatory changes or malignant new growths that are at fault. In short, the causes of the obstruction may vary, but the pain phenomena induced are the same. It therefore seems to me justifiable to classify separately the paroxysms of this type and to give them the new designation of pyloric colic. In the pathogenesis of this it appears to me that—as in the stenotic colics in general—the factor of overdistention is of greater importance than that of muscular spasm. The quality of the pain itself and particularly the accompanying symptoms in advanced cases, such as visible peristalsis, leave no doubt in regard to the underlying causes. At the acme of the paroxysm the patients nearly always complain of pain that is exquisitely colicky and griping in character and is associated with the sensation "as if there were something alive in the stomach region," "as if the stomach were contracting vio-

lently and there were an obstruction to the exit of its contents.'' The spasmodic attempts of the gastric muscles to force the contents of the organ through the stenosed pylorus manifest themselves in this way and sometimes even the direction of peristalsis from left to right is manifest to the sufferer. The distention that is ordinarily also present gives rise to an extremely disagreeable or even painful feeling of fulness.

Objective Symptoms.—Although the subjective sensations of the patient depending on the underlying conditions of spasm and overdistention give a sufficiently clear picture of the actual condition, the other objective symptoms banish all doubt, at least in well-marked cases. The cardinal phenomenon is the fact that the contours of the stomach are rendered visible and palpable. At the same time gurgling and rumbling sounds may be heard. This so-called rigidity of the stomach is often observed by the patient himself as a ''hardening'' of the epigastrium, which is likely to be most marked on the left side. It corresponds in time fairly closely with the paroxysm of pain. The distended stomach does as a matter of fact become harder to the touch and is palpable as a mass resembling an inflated air-cushion in consistency. This is a symptom that deserves consideration in all cases of gastric pain in which pyloric stenosis is suspected. If the abdominal muscles are well developed and the stomach is not greatly dilated the abnormal increase in peristalsis may not be visible, but can be detected on palpation

as a rapid change in the degree of tension of the organ. In testing for this it is advisable to palpate with the outspread fingers pressing vertically against the abdominal wall, especially over the left half of the epigastrium and below the left costal border. In some cases, particularly if there is no gastric distention, an increase in the pyloric resistance may be felt at the onset of the pain. The sausage-like transverse mass so formed disappears again as the pain subsides. If the stomach is more dilated and approaches the vertical in position peristalsis is often most marked in the neighborhood of the umbilicus and little eminences appear at either side of this. More rarely the protuberance is in the neighborhood of the gall-bladder. A similar observation is sometimes made by patients with gall-stones and is due to a specie of erection of the gall-bladder. The auscultatory manifestations have the same origin as the visible and palpable phenomena and correspond to the loud borborygmi accompanying intestinal stenosis. They are caused by the gurgling of gas through the narrowed pylorus and are ordinarily followed by decrease of the tension of the gastric wall and subsidence of the paroxysm of pain. The evacuation of gas upward through the cardia has the same effect. The violent peristalsis battling against the pyloric obstruction also often produces eructations of sour material accompanied by retrosternal pyrosis which may extend up into the throat. Finally, there may be vomiting of an abundance of material that is not bile stained, the act being usually

followed by cessation or considerable diminution in the pain, as opposed to the vomiting of biliary colic. Although in the typical cases with marked dilatation the large quantity of the vomitus, which comes up in great gulps, and the facts that the material brought up is almost never bile stained, frequently contains old food particles and sarcinæ, and is often hyperacid, usually make the recognition of the underlying conditions easy, there are other instances in which, in spite of years of stenosis, there is never vomiting, no sarcinæ are to be found in the gastric contents, and there may also be no food residue in the fasting stomach. In these cases there is probably a compensatory change without extreme stenosis, and instead of dilatation there is rather a concentric hypertrophy of the muscular layers. The absence of vomiting may also be caused by perigastric adhesions, and in such cases the careful study of the attacks of colic may be of great diagnostic importance. Of other symptoms frequently observed there may be mentioned the belching of gas having the odor of putrid eggs (SH_2); the microscopical pendant to this is the discovery of sarcinæ. Another typical manifestation is the presence of gastric splashing, which may be elicited at any time, and is often noticed by the patient in walking. It is only rarely (in neuropathic patients with an excitable vasomotor system) that a short chill accompanies the attack of colic. Elevations of temperature do not go with the seizures of pyloric stenosis, as opposed to biliary colic. Constipation is a regular concomitant in almost every

case of well-marked pyloric stenosis and is aggravated at the time of the attack. The urine is often dark in color and reduced in quantity owing to the loss of fluid through vomiting.

Time of Onset.—The time at which attacks of pyloric colic occur is fairly regular. In most cases the pain begins two to three hours after the midday meal; more rarely after the lapse of one to four hours. At this time the expulsion of the gastric contents through the narrowed pylorus, or an attempt at this, takes place. Gastric rigidity sets in and gurgling sounds are audible, while gas is belched up and there are eructations of sour fluid. In short, in typical cases there appear the various manifestations of increased but ineffectual peristalsis. Large quantities of indigestible food cause delay in the onset of the pain, but increase its severity. The attacks often last from two to three hours, and are ordinarily terminated by the onset of copious vomiting. These afternoon attacks depending on the ingestion of the midday meal are in many cases followed by nocturnal seizures that are regular in recurrence but do not exhibit a distinct connection with the evening meal and have a greater resemblance to the irregular paroxysms of biliary colic. In some cases this nocturnal type even predominates. As in colic of other sorts the attacks are most likely to occur at about midnight, lasting several hours until vomiting relieves the pain.

Topography.—In regard to the situation of the pain I should like to consider especially the ten-

dency to radiation, which is also prominent, as is well known, in gall-bladder colic. This appears to depend in part on the degree of tension of the stomach wall. On the evacuation of gas by belching, there is often abrupt cessation of the radiating pain; for example, that passing into the back. Several types may be recognized from the topographical standpoint, but they all have a stenosis of the pylorus (cicatricial) as underlying cause.

1. *Type of Pseudo-gall-stone Colic.*—The pain of the attack begins in the epigastrium or in the pyloric and gall-bladder region, and radiates into the right lumbar region and right shoulder. It accordingly simulates that of biliary colic, and error is to be avoided only by a careful analysis of the attendant circumstances, time of onset, etc. The difficulties may be still further increased in those fortunately rare cases in which pyloric ulceration—through infection, secondary duodenal catarrh, or adhesions—leads to lesions in the gall-bladder or gall passages, and therefore causes jaundice.

2. *Type of Gall-stone Colic with Left-sided Pain.* The pain begins on the left side of the epigastrium and radiates into the left lumbar region, left shoulder, and possibly left breast. Owing to the left-sided position of the distended organ this type appears to be commoner than the preceding.

3. *Type of Pseudo-girdle Pains.*—The pain begins exactly in the middle line of the epigastrium and extends in girdle form with equal intensity to each side to the back. It may also radiate retrosternally and into both shoulder blades.

4. *Type of Diagonal Radiation.*—The pain begins, for example, in the right half of the epigastrium in the immediate neighborhood of the gall-bladder, but radiates backward, especially into the left shoulder. Such left-sided radiation is of value in differentiating the condition from the ordinarily right-sided biliary colic.

Modifying Factors.—In this connection mechanical factors are of great importance, particularly in regard to the position of maximum pain (*cf.* page 24). Lying on the right side is very likely to bring on the pain or to increase it if already present. During the intervals between attacks this position is often well borne, however. I have already indicated my doubts in regard to the assumption that the explanation is to be found in a simple settling or displacement of the stomach contents on to the surface of the ulcer or the cicatricial tissues. This view is also opposed by the observation that in some cases of ulcerative cicatricial pyloric stenosis the right lateral position is well borne, but the left is accompanied by nausea, belching, etc., so that the patients turn on the right side during the attack. Sometimes in the course of the disease a change in the position of maximum pain is observed so that for a time it may be the right and later the left side. It is of especial interest to note that in such cases immediately after a gastro-enterostomy has been done there is no longer any painful position. The following case illustrates this in a typical way:

A farmer's wife, aged thirty years, came under observation on October 21, 1901. Her present symptoms have developed gradually during the past four years. To begin with, there were cramp-like pains in the stomach, at first only in the daytime and sometimes not appearing for several days. A month after the first of these seizures she began to vomit, often bringing up a pint of acid, watery fluid. After vomiting the pain ceased, only to recur on taking food. Later the pain began to be more on the left side of the epigastrium and to radiate backward into the left flank and to the angle of the scapula. During the attacks there was swelling below the left costal margin and loud gurgling followed by some diminution in the pain. The seizures frequently came on between eleven and twelve at night and were accompanied by a feeling of fulness and distention. Taking a meal at noon would be followed by pain at about three in the afternoon. There was intolerance of vegetables, starchy desserts, beer, and wine. At first she could lie on either side, but in the course of a year she became unable to lie on the right side during the attacks. She had the feeling as if everything were "dropping over" to that side. For some months she had been in the habit of lying on her face during the attack with one hand pressed against the epigastrium and the other making counter-pressure over the back. She frequently massaged the epigastrium with the closed fist. Evacuation of the bowels seemed to lessen the pain. The physical examination showed among other things that the stomach was tense, like an air cushion, with active peristaltic movements. The vomitus contained hydrochloric acid and many sarcinæ. She was operated on in Gussenbauer's clinic on November 5, 1901. The pylorus was found drawn close to the cardia by a wedge-shaped scar along the lesser curvature which was also adherent to the pancreas. A gastro-enterostomy was done, and two weeks later the patient could eat everything, had no symptoms whatever, and could lie on either side.

It has been pointed out above that it is therefore much more rational to consider that the effect of position depends on kinking, traction, inflammatory adhesions, etc. The part played by the overdistention of the stomach in bringing on the attack is demonstrated by the fact that the belching of gas and vomiting relieve or cut short the paroxysm.

Many patients instinctively massage the distended epigastrium or they furnish a support to the anterior stomach wall by pressure with the fist, and in this way favor the evacuation of gas.

It is often possible to demonstrate the presence of pyloric tenderness by percussion and deep palpation. Frequently it is more or less limited to a point in the linea alba between the navel and the xiphoid process. Sometimes there is tenderness of the spinal column to percussion between the shoulder blades. The influence of diet manifests itself in the same way as spoken of under the heading of ulcer. It is hardly necessary to emphasize the fact that owing to the narrowing of the pylorus the ingestion of foods tending to produce distention or fermentation is very likely to cause gastric meteorism, and that these are particularly to be avoided. The following articles are nearly always very badly borne: Potatoes, turnips, uncooked fruit, cabbage, smoked meat, and fatty foods in general, as well as pastries prepared with yeast, and alcoholic beverages, especially sour wines. Foods that agree well are thick rice soup, spinach, potato purée, tea with milk, milk dishes, chopped ham, etc. The drinking of large quantities of fluid is always of untoward effect. Irritating substances like whiskey or black coffee sometimes give symptomatic relief. Evidently they encourage the discharge of the gastric contents and so relieve the tension of the over-filled stomach.

In speaking of thermic stimuli I wish only to point out that in those cases of pyloric colic accompanied by considerable distention of the stomach,

the application of cold, possibly through its tonic effect in encouraging contraction, seems to be more beneficial than the various warm applications ordinarily used in attacks of colic. In some such cases I have seen heat not only unproductive of relief but the patients have even complained of increase in their sufferings. Internally, lukewarm drinks are to be recommended.

What was said concerning the effect of the functions of other organs on the pain of ulcer is also applicable here. The indication for careful regulation of the intestinal functions is the more important since the tendency to gastric meteorism is evidently more pronounced than in cases of ulcer not accompanied by stenosis. There is no doubt in regard to the effect of constipation in increasing pain. Psychical factors, such as overwork or excitement, frequently cause the attacks to recur at shorter intervals. Disregard of this fact might make confusion with functional conditions likely.

Differential Diagnosis.—The possibility of mistaking pyloric colic for biliary colic is particularly great in those cases in which the characteristic evidences of pyloric stenosis, such as gastric rigidity, very copious vomiting, etc., are absent, or in which jaundice appears as a result of secondary duodenal catarrh. Sometimes, though fortunately rarely, the two conditions occur in combination. Some of the more important differential signs may be summarized in the following table:

Pyloric Colic.	Biliary Colic.
Active borborygmi in the epigastrium.	
Distention, most marked below the left costal border.	Swelling of the gall-bladder and of the liver.
Acid eructations with heart burn; copious vomiting of strongly acid material that is not bile stained but contains sarcinæ and possibly particles of old food.	Vomiting of bitter material that is bile stained and is not very great in amount.
Eructations smelling of SH_2.	
Copious vomiting or eructations of gas are followed by a marked diminution in pain.	Vomiting has no noteworthy effect on the pain or it may even increase it.
Usually no chill.	Often a chill followed by elevation of temperature.
The fasting stomach contains old food.	
Attacks are very numerous, often occurring daily for weeks and months.	Attacks are sporadic, frequently with intervals of several months.
The pain tends to radiate to the left.	Tends to radiate to the right.
The attacks regularly begin two to three hours after the midday (or largest) meal.	Irregularity in time of onset, or a longer interval after eating (about 5 hours).
Foods causing gas formation tend to increase the pain.	The nature of the food is of comparatively slight effect.
Attacks of colic are sometimes brought on by lying on the right side.	The left lateral position is often badly borne and is accompanied by a feeling of painful traction on the right.
Local anæsthetics sometimes relieve the pain.	Urine in some cases contains bilirubin or urobilinogen.

Numerous as the differential signs are, it may in some cases be exceedingly difficult to distinguish between these widely separated pathological conditions. On the one hand, there are cases of very slight

pyloric stenosis in which there is good compensation and the objective cardinal symptoms are absent or few, but in which, possibly in consequence of general irritability of the nervous system, the attacks of pain may be extremely severe; while on the other hand cholelithiasis may be accompanied by symptoms such as gastralgia, or pain due to adhesions between gall-bladder and duodenum, which arouse the suspicion of a pyloric stenosis due to ulceration. Finally, of course, the two conditions may coëxist.

Tuberculous Intestinal Ulceration.—Ulcerative processes in the small intestine causing stenosis may give rise to error, particularly if the intestinal symptoms are not well marked. So in one case observed by the author which came to operation, the stools were normal, gastric symptoms, comprising dilatation with persistent splashing, vomiting, etc., were prominent, the effect of diet was as in pyloric stenosis, but the condition was one of very slight chronic intestinal stenosis due to tuberculous ulceration. In this connection attention should be directed to pain in the lower abdomen, which generally does not occur in pyloric colic. On the other hand, I attach little diagnostic value to visible intestinal peristalsis of slight degree, particularly if the abdominal wall is relaxed and thin. I have frequently seen this at the acme of gastric peristalsis in undoubted cases of pyloric stenosis, and regard it as being due to a sort of sympathetic activity. Further differential points may be found in the chapter on gastric ulcer.

GASTRIC CANCER.

In view of the various anatomical lesions accompanying the development of gastric carcinoma, such as pyloric stenosis, ulceration, perigastritis, metastases in the liver, retroperitoneal glands, etc., as well as direct extension to neighboring structures, it might well be expected that the course of the disease would be accompanied by pain. As a matter of fact this is true in a certain number of cases, and the character of the pain as well as its modifying factors often indicate the manner of its causation.

Pain as an Early Symptom.—While pain not rarely begins very early, often at a time at which anorexia has not yet set in and the general condition is good, this is to be explained by the fact that in most such instances the growth has commenced very near the pylorus and is causing obstruction at that point. This stricture of the pyloric region, which at first is probably purely spasmodic, manifests itself in a series of subjective sensations which, according to the degree of stenosis and other circumstances, such as the motility and total acidity, closely resemble those described in the section on pyloric colic. At any rate, these subjective sensations precede the objective evidences of pyloric stenosis, such as gastric rigidity, by a considerable period of time, and this very fact gives them a distinct importance. This spontaneous pain due to the early onset of pyloric stenosis may be contrasted with other artificially evoked pains that indicate ulceration and are the result of the anatomical process (new growth

formation and ulceration) *per se*. We must therefore discuss:

I. Pain due to the local process, which usually leads to pyloric stricture.

II. Pain caused by the local invasion of other organs, or distant metastases.

III. Pain resulting from inflammatory complications, such as perigastritis and local or diffuse carcinomatous peritonitis.

I. *A priori* it might be expected that the phenomena comprised under this heading would be identical with those described in the section on pyloric stenosis which was devoted to the benign cicatricial stenosis. One would suppose that the malignancy of the ulcerative process would not alter the character of the pain. In fact, there are cases of gastric carcinoma which during their entire course are accompanied by just such painful phenomena, peculiarities of radiation, etc., as were described in the chapter referred to. In general, however, the intensity of the spontaneous attacks is less and the progress of the stenosis and increased activity of peristalsis are often accompanied by a marked decrease in the pain, so that it may be said that benign pyloric stenosis is much more painful than the malignant form. The rather paradoxical-appearing fact that the malignant stenosis is exceeded in pain by the benign process is readily explained on more careful consideration. The mere decrease in appetite accompanying carcinoma causes dietary errors —which are so often responsible for attacks of colic

in benign stenosis—to be much rarer. In addition the musculature of the carcinomatous stomach early becomes atonic, whereas in ulcer it is more likely to be hypertonic, or at least in a condition of irritable weakness, which renders it easily excitable and prone to spasm. At the very beginning of the affection the pain in carcinoma may present great similarity to that of ulcer. While the appetite is still good, the dietary is not appropriately restricted, and therefore the early stages of a carcinoma are sometimes accompanied by very intense pain. One of the most frequent initial symptoms of cancer of the stomach is a sensation of pressure in the epigastrium, usually occurring about half an hour after eating. Sometimes this is simply a disagreeable, uncomfortable feeling, but in others it already has the quality of pain. The patients often speak of "a heaviness in the stomach." This sensation of fulness, tension, or pressure in the epigastrium, sometimes accompanied by "burning," appears to correspond to the first degree of commencing narrowing of the pylorus, and may be the result of a functional spasmodic stenosis, for at this time other objective symptoms of permanent organic stricture are usually absent. Sometimes it is possible at the moment of appearance of this sensation, which frequently lasts for only a short time, to detect a momentary air-cushion resistance in the epigastrium due to a wave of contraction of the organ. If the stenosis increases, stronger contractions striving to overcome the obstruction appear, and these are manifested to the patient as

pains of a knife-like boring and twisting character. Sometimes the sensation is described "as if a ball were rolling around." These are true colic pains and the spasmodic contraction in the epigastrium may become exceedingly violent; in such cases it is usually followed by vomiting.

Accompanying Symptoms. — These variously graduated sensations, ranging from a simple feeling of pressure to colicky pain, may be accompanied by other manifestations also differing in intensity. The slight initial grades of stagnation and the subjective sensation of simple pressure, which often is not really painful, may be accompanied by eructation of small quantities of acid fluid, frequently accompanied by heartburn, or there may be belching of odorless gas; while in benign stenoses the gas has the odor of putrid eggs (SH_2). Copious vomiting, or indeed vomiting at all, does not usually occur during this initial stage of epigastric pressure after eating. It has already been pointed out that not infrequently advanced malignant stenoses exhibit a contrast between the intensity of the stenosis and the slightness of the pain, and an explanation for this has been offered. If a benign stenosis becomes malignant an apparent improvement may result, as the attacks of pain sometimes become less or cease entirely. It may also be mentioned that in malignant stenosis bile-stained, yellow-colored vomitus is more frequent than in cases of benign stricture, owing to the absence of marked pyloric spasm in the former condition.

The vomiting of a coffee-ground character, which occasionally accompanies the benign stenoses, has been mentioned above. In the stage of simple epigastric pressure, anorexia is not usually present. On the other hand, there is a certain amount of intolerance for meat and solid food, especially cooked food, and, even earlier, intolerance for vegetables and for beer. Sluggishness of the bowels deserves to be mentioned as a symptom which is occasionally very early in its occurrence and is rarely absent in the later stages.

Chemical and microscopical examinations of the stomach contents are rarely decisive during this initial stage of subjective symptoms. It is always well to note the presence of slight bulging of the epigastrium, especially in its left half, which represents a rudimentary peristalsis and is present especially after the taking of food. This symptom, of course, as well as the rigidity of the epigastrium which comes a little later, depends more or less upon the development and natural stiffness of the abdominal muscles.

Occasionally the colicky pains occur two or three hours after meals. In other cases they show a decidedly nocturnal type (eleven o'clock at night, lasting until about two A.M.). Frequently, however, they follow directly upon the taking of food. The feeling of heaviness, especially, occurs either immediately upon, or within a half hour after, the taking of food. Only in very rare cases are these pains postponed for a longer interval than six to seven hours after a large meal.

In regard to the abdominal regions involved, a great similarity with the previous conditions may be observed. In many cases, for instance, there is a definite relation between the posture of the patient and the pain. When the patient lies on the right side, there is commonly an increase of pain, abdominal bulging, and nausea. Here, as in the case of the pain accompanying pyloric stenosis, the suffering is immediately ameliorated by the belching of gas and by vomiting. In every respect where the mechanical agencies are involved the analogy of this condition with pyloric stenosis is so close that the subject can be dismissed by referring to the chapter on pyloric stenosis.

There is a marked similarity also in regard to the influence of diet upon the pain. The sensations of pressure and of hunger which so frequently occur in neuroses of the stomach, in which the pain is alleviated by the taking of food, occur but rarely in this condition. It is an almost invariable rule that food increases or begins the pain, and in this respect the quality of the food plays a very important rôle, the most troublesome articles of food being boiled beef, heavy vegetables, rye bread, and fluids of all kinds, especially beer and acid wines.

We have still to consider the localization of the pain, and in this connection we must differentiate between

(a) Spontaneous pain, and

(b) Artificially induced pain produced by pressure and percussion.

(a) *Spontaneous Pain.*—The pain is usually projected forward into the epigastrium. More rarely it is situated retrosternally under the lower half of the sternum. In the epigastrium there may be variations in the position of the pain just as in gastric ulcer. In some cases the left side of the epigastrium becomes the most painful area; in other cases the mid-line is the seat of greatest pain; and, again, in other cases, the suffering is chiefly localized over the pyloric region. The subjective pain may remain localized here, or, just as in benign stenoses, it may radiate especially into the loins and back, toward the hypochondriac regions, and occasionally even into the shoulder blades. The pain which occasionally is noticed as radiating up behind the sternum into the throat is usually accompanied by regurgitations of the acid stomach contents, and may easily be controlled by small doses of alkalies. This must not be confounded with the sensation of a foreign body rising upward, or the globus hystericus, occurring in hysteria. Those pains in the back which are produced by a pyloric stenosis and secondary dilatation of the stomach as such, and not by metastases, are in direct proportion to the epigastric pains, are increased and decreased with these, and are simply backward radiations of these pains. Their appearance seems to be favored by constipation and they disappear with thorough emptying of the bowels. Such pains may occasionally be produced when the stomach is artificially inflated, a fact which may be regarded as important in clearing up the mechanism of such sensations.

(b) *Artificially Induced Pain.*—Not infrequently it is possible to map out by palpation, and occasionally even by percussion, a definite hyperæsthetic zone in the epigastrium, which frequently corresponds to the position of the tumor. In those cases where a tumor is impalpable on account of its small size or of great muscular development of the epigastrium, the localization of such a hyperæsthetic area may, if cautiously interpreted, give much diagnostic aid. If such a zone be placed asymmetrically on the left or right side below the costal border, it will be more worthy of notice than if placed mesially.

As in gastric ulcer, the vertebral column in its interscapular and dorsolumbar regions, as well as in the left lumbar region, is frequently painful to percussion.

II. Following the classification proposed above, we are now about to deal with those painful sensations which depend upon local extension of the process as well as upon metastases into other regions. These are, of course, of much less importance, since we are no longer dealing with early symptoms; on the other hand, they will find further mention when we reach the discussion of organic pains of other regions (hepatalgia, etc.).

These pains, in contradistinction to those dealt with above, are differentiated in general by their persistence and by their independence from digestive influences, so that even when localized in the epigastrium (metastases into the liver, pancreas, and glands), they are easily separated from the pains previously described.

III. Inflammatory complications are often the basis for the pain occurring with gastric carcinoma; this may be more or less local, as in fibrinous or purulent perigastritis, or diffuse, as in carcinomatous peritonitis.

The new growth itself does not seem to be particularly sensitive to pressure. In cases where a more severe sensitiveness to pressure exists, we are usually dealing with a superimposed inflammatory process in the ulcerated tumor mass. A localized peritonitis may occasionally be evidenced by a noticeable leather-like creaking brought out by palpation. The motion of the tumor mass in such cases produces pain by rubbing against the inflamed portions of the peritoneum. This may be brought about by coughing, bending forward, pressure during defecation, deep breathing, etc.

Rapid changes of position also (from the dorsal position to the right or left) may in the same way, by producing sudden motion of the tumor, give rise to local pain. Whenever the perigastric process extends, giving rise to subphrenic abscesses or to pleurisy, which seems to occur usually on the left side, pain will occur, on this side in the lower intercostal spaces, in addition to the epigastric pain.

But in cases where the peritoneum, as a whole, is involved in the carcinomatous process inflammatory changes usually take place and give rise subjectively to general abdominal tenderness, and to a painful sensation of general distention.

The pain which depends upon peritoneal involvement may frequently be influenced by local treatment (sapo kalinus, tincture of iodine, alcoholic compresses, etc.); on the other hand, lavage, which frequently relieves pains due to stagnation in the stomach and overdistention of its walls, increases the pain when we are dealing with a perigastric condition, in that it is contrary to the first principle of treatment in inflammatory processes, *i.e.*, immobilization.

It is only after a careful consideration of all the elements involved, and a careful physical examination, that we can reach the conclusion that certain pains are due to the development of a gastric carcinoma. Of the most practical importance are the epigastric sensations which have been described under I., and which appear at a time when other symptoms, such as anorexia, progressive emaciation, achlorhydria, etc., are still absent, and the patient is as yet unaware of any severe illness.

In this connection all those conditions which have been mentioned under gastric ulcer and pyloric stenosis must again be considered in making the differential diagnosis. The greatest difficulty will be encountered in the exclusion of gastric ulcer, both in its development and in its recurrence. Suspicions of carcinoma will be strengthened when the general symptoms of gastric ulcer and anorexia persist, in spite of rest in bed and regulation of the diet. The greater the effect of mechanical factors in influenc-

ing the pain, the less the likelihood of the condition being a gastric neurosis. Difficulty may occasionally be experienced in separating carcinoma of the stomach from the dyspepsia which accompanies cases of chronic tuberculosis. This may occur with but slight involvement of the lungs and may give rise to such extreme anorexia and progressive emaciation that the suspicion of early carcinoma is aroused. These cases, however, are rarely accompanied by the attacks of spontaneous epigastric pain seen in carcinoma. Even in tuberculosis it is not rare to find epigastric tenderness, and this is easily explained by oversensitiveness at the insertion of the recti, produced by severe paroxysms of coughing.

TUBERCULOUS INTESTINAL ULCERATION AND INTESTINAL STENOSIS.*

Ulcerations of the gut give rise to more or less characteristic phenomena of pain, though they do this less regularly than do ulcerations of the stomach. Tuberculous ulcerations are the most frequent, and they may be taken as an example of intense intestinal ulcerative and obstructive conditions throughout. Tuberculous ulcerations, however, give rise to attacks of pain more characteristic than those arising from other intestinal ulcers (for instance, those of typhoid and dysentery). This is because they have a greater tendency to produce stenosis, and during their existence the pain is less defi-

* *Cf.* page 63.

nitely under dietetic control than is generally the case in typhoid and dysentery.

Similarly to gastric ulcers, the tuberculous ulcerations of the gut may remain entirely latent. This, however, is not frequently the case. The production of stenosis is here, as in conditions of the stomach, one of the chief causes of pain; added to this, of course, are the conditions of enteritis, abnormal fermentation, and the peritoneal lesions produced by perienteritis. The following observation may serve as an example of the colic produced by tuberculous stenosis of the gut, and also illustrates how acutely the first symptoms may set in, in spite of the chronicity of the process.

A maid-servant, eighteen years of age, was taken on November 4, 1906, with anorexia and during the following eight days there were no movements from the bowels, which previously had been regular. Severe colic followed within ten minutes on taking bread, meat, or cold fluids. The pain began in the epigastrium and radiated to the ileocæcal region. There was no vomiting. The stools were hard and of lead pencil type, or else of mucous fluid, containing lactic acid bacilli in great numbers. Later the attacks began in the ileocæcal region and radiated upward to the epigastrium. From November 10 to 18, the pain was almost continuous night and day with only five-minute intermissions; the bowels were kept open by means of cathartics. During the seizures she felt as if the intestines were tearing open, and she would run about the room. Cordials gave some relief to the pain, but changes of position had no effect. The pressure of the waistbands was painful. There was seen to be active periumbilical peristalsis, there was no noteworthy distention in the flanks, but there was loud intestinal gurgling. Movable dulness could be demonstrated in the flanks. There was much indican in the urine, which also gave strong acetone and diacetic acid reactions. The stools now were mucous, with pus, red blood-cell shadows, and many lactic-acid bacilli. On Novem-

ber 19 there was slightly fecal vomiting with many lactic acid bacilli. At the operation in Hochenegg's clinic it was found that about 3 cm. above the ileocæcal valve the ileu was the seat of a cicatricial stricture for a distance of 5 cm. and was sharply angulated. Above the stenosis the gut was much distended and hypertrophied.

The pain accompanying stenoses is closely analogous to the colic resulting from pyloric stenosis. Even the localization of the pain is occasionally very similar, so that the patient when consulting the physician describes it as epigastric. Spontaneous pains frequently begin in the epigastrium. Radiation, in these cases, towards the ileocæcal region is of considerable importance, since such radiation is very uncommon in gastric conditions. This may be due to the anatomical position of the lesion, since the ileocæcal region is involved with special frequency.

Pain is noticed in the umbilical region rather more frequently than in the epigastric; here it may occur to the right or left of the mid-line, and may extend to both sides, encircling the body. The most common seat of the pain, however, is the hypogastric region, and here it occurs especially in the right side. The pain is usually projected forward; it rarely is localized in the back; but when it is, the posterior pain is always accompanied by the anterior pain, and is directly dependent upon the taking of food.

The objective pains produced by pressure or percussion generally correspond, in localization, with the subjective ones; therefore the ileocæcal region

is almost always sensitive. This is likewise true of the hypogastrium, especially when there is distention. There is frequently a well-localized painful zone in the neighborhood of the umbilicus which, especially if situated above the umbilicus, gives rise to a suspicion of gastric ulcer. In such cases it is important to determine whether or not this area of pain is situated above or below the major curvature of the stomach.

The time of occurrence of the pain is, in many cases, in direct relation to the taking of food. This is especially noticeable in connection with the large meal in the middle of the day, which is followed, with more or less regularity, within one half to one hour, by attacks of pain which may last for several hours. While the length of this interval between the meal and the onset of pain varies greatly in different individuals, there is great constancy in the duration of the interval in the same individual, in that attacks occur in one case with great regularity in from three to four hours, in other cases in from six to seven hours after meals. Whenever a very short time elapses between the meals and the appearance of the pain, we are undoubtedly dealing with a stimulation of intestinal peristalsis produced by the food still remaining in the stomach; and it is this peristalsis which produces the pains in the ulcerated area. It is important to note that patients with this form of intestinal ulceration may experience entire freedom from pain during intervals often lasting for months. As the disease progresses, these free in-

tervals become shorter and shorter, until the attacks are of daily occurrence; this is due, of course, to the constantly increasing stenosis.

Mechanical Considerations.—Since the condition is most frequently localized in the ileocæcal region, the pain is usually most severe in this region. Thus the patients, when lying on the left side, complain of feeling as though something were being drawn from the ileocæcal region into the left side, while when lying on the right side the pain is directly localized in this region. In general, the position on the left side is less painful than that on the right. This is undoubtedly due to the traction brought about by the weight of the diseased gut and of the involved glands, a traction which is the more painful because peritoneal inflammations and adhesions are comparatively frequent.

The condition may be confused with cases of acute and chronic appendicitis where the same peculiarities as to the relation of pain and position are present. This error is more easily made because in both of these conditions the patient will be relieved by flexion of the right leg at the hip through relaxation of the abdominal muscles during the attacks.

The pain which is elicited in circumscribed areas, especially the hypogastric and umbilical regions, by jarring of the body, as in coughing, walking downstairs, rapid turning and deep inspiration, is easily explained by the correspondingly localized inflammatory processes in the peritoneum.

A number of other minor symptoms unquestionably depend upon the fact that the intestinal pain is frequently accompanied by local or general distention. Thus the patients, during their attacks, rub the hypogastrium, place their hands upon their hips and turn the trunk upon the pelvis in an instinctive attempt to cause a general distribution of the local distention. The same fact explains the relief produced by enemata, by vomiting, or by the discharge of gas per os or per anum, all of which bring about a relief of the distended intestinal wall.

The influence of the diet upon the pain is dependent upon this very question of distention; and the same conditions which we considered in speaking of gastric ulcer and of pyloric stenosis must be taken into account here. In the first place, those articles of diet which give rise to fermentation will cause pain. Chief among these are cabbage, turnips, lentils, potatoes, pastries prepared with yeast, rye bread, beer, not infrequently milk, and furthermore all those articles of diet which are apt to constipate.

Great pain can be produced by those articles of diet which produce active peristalsis when present in the stomach; this probably explains the attacks of pain which regularly occur a few minutes after the ingestion of cold beverages (water, milk), strong coffee, and certain drugs, as thiocol; on the other hand, these very articles which stimulate peristalsis may aid in relieving local distention and thus have the opposite effect. Direct chemical irritation of the ulcerated areas probably occurs very rarely;

but if it does occur this may explain the production of pain by very acid food such as salad. More frequently mechanical injury may be caused by the ingestion of solid food, especially raw fruit; so that in general a fluid or semi-solid diet is to be preferred.

It is self-evident that the quantity of food introduced may, by its filling of the intestine, become a serious consideration in the production of pain.

Just as the introduction of cold substances may produce pain by their active stimulation of peristalsis, so also thermic influences brought to bear from without may play a similar rôle.

Chilling of the feet seems to have special influence in initiating attacks of pain. Thus attacks may be brought on by walking upon a cold floor with bare feet. This is, in general, a peculiarity of pains due to intestinal peristalsis and may have a certain amount of differential value. Applications of cold compresses to the abdomen, in that they relieve distention, usually have a favorable influence; while the application of heat often increases the pain.

The secondary symptoms are especially important because they so frequently give rise to errors in diagnosis.

The importance of this fact is well illustrated by those cases of tuberculous ulceration which are accompanied by gastric symptoms, vomiting and belching. The vomiting is often in large quantities, and in the vomitus there are frequently particles of food which have been ingested several days before. In these cases we are unquestionably dealing

with stagnation in the stomach, secondary to the obstruction in the gut. The very facts that the vomiting is copious, that the microscopical examination points to stagnation, and that the clinical signs obtained on palpation indicate moderate dilatation, may give rise to the erroneous diagnosis of pyloric stenosis. This error may be more easily made since the pain in these cases is often localized in the epigastrium, and occasionally there may be an entire absence of symptoms referable to the intestines, such as diarrhœa, or even irregularity of the bowels.

In doubtful cases it is particularly important to remember that, in contrast with pyloric stenosis, the vomitus frequently contains bile, and the pains are radiated either into the hypogastrium, or, more frequently, into the ileocæcal region . The discovery of sarcinæ in the vomitus is pretty positive indication of the gastric nature of the condition. On the other hand, the presence of large numbers of lactic acid bacilli in the fæces or vomitus, is not to be taken as direct evidence of a malignant pyloric stenosis. These organisms may also be found in tuberculous stenosis of the small intestine, and if discovered in the stools may be of assistance in making this diagnosis.

Diarrhœa, especially the very foul variety which occasionally accompanies tuberculous ulcerations, is almost unknown in cases of pyloric stenosis. These are almost invariably accompanied by constipation. For this reason, too, the succussion noticed occasionally in cases of tuberculous ulceration is extremely rare in pyloric stenosis.

It is sometimes extremely difficult to distinguish the condition under consideration from acute or chronic appendicular inflammations. This is true particularly because the point of maximum tenderness may often be located in the right ileocæcal region, and paræsthetic sensations may occur on the inner surface of the right thigh. Flexion of the right leg at the hip during the attacks and slight distention of the right ileocæcal region aid in confusing the picture. Occasionally bladder symptoms are present, due to pressure of the full bladder upon the inflamed parts.

Great help can be derived in such a confusion of evidence from a positive diazo reaction; in contrast to appendicitis, too, ulcerations of the gut even during the colicky attacks may be entirely free from temperature. Added to this we may have a previous history of long-continued symptoms of slight intestinal obstruction and the general evidences which point to tuberculous trouble, night-sweats, pulmonary symptoms, etc.

In those cases in which the stenosis is slight, visible peristalsis is often limited, and is noticeable particularly in the ileocæcal region and in the immediate neighborhood of the umbilicus. The peristalsis is often accompanied by crackling sounds produced by the passage of gas through the stenosis, which is followed by relief from pain as the pressure upon the overdistended gut is diminished. While occasionally slight chilly feelings, or in severe cases even collapse, may occur in this condition, a true shaking chill is extremely rare.

It would be impossible to review all the conditions which make a differential diagnosis in this condition difficult. It is, however, advisable to be suspicious of tuberculous ulceration of the gut in all those cases of abdominal pains of colicky nature in which there are any other factors in the history or in the physical examination which point to a tuberculous tendency in the patient.

DISEASES OF THE APPENDIX.

It is not wise to speak in a vague way of "appendicular colic." The acute or chronic inflammatory conditions of the appendix originate from a variety of causes, and it is necessary to understand clearly the pathological basis of the pains which occur in each of these conditions in order to draw diagnostic conclusions from them. It is generally assumed that the colicky pains in appendicular conditions are primarily due to the intra-appendicular pressure of inflammatory exudates, which cause contractions of the musculature, and a condition not unlike neuralgia. This is an assumption which has much in its favor and cannot be dismissed lightly. This explanation of the pains, however, is entirely insufficient for the more chronic conditions where the appendix is well imbedded in the surrounding inflammatory thickenings. Here, of course, distention of its lumen and contraction of its muscular walls are quite out of the question. I should like to suggest that it is quite possible that many of these so-called cases of appendicular colic are nothing more than a

simple intestinal colic reflexly initiated in the appendix, and even the stomach may be involved in this way. In these cases intestinal inflammations seem frequently to have preceded, the attack of appendicitis occurring during an acute exacerbation of these. This assumption would be supported by the frequency with which the parasitic flora of the feces is changed from the normal in cases of appendicitis, and would explain the previous diarrhœas which often are present during the early development of appendicitis.

Comparison of the pains in appendicitis with those in tuberculous ulceration of the intestine shows many points of similarity. Distinction between the conditions would be almost impossible, as far as the pains themselves are concerned, were it not that in contrast to the intestinal pains of other diseases, in appendicitis we have added the pains due to peritoneal inflammation, and from this a number of important differential symptoms can be deduced.

The early pains of appendicitis rarely correspond in localization to the position of the appendix. Usually the pains begin diffusely in the umbilical and hypogastric regions, occasionally in the epigastrium, and differ in nothing from the pains of ordinary intestinal colic following errors of diet, or acute gastro-enteritis. The suspicion of appendicitis at this stage is not aroused by the character of the pains but depends upon the secondary symptoms, such as temperature, etc., and the absolute absence of the usual causative agents of intestinal colic. It

is only the rare cases which begin with localized pain over the appendix, or even with a distinctly right-sided pain. Occasionally, there may appear radiations of the pain into the right inguinal or lumbar regions, and this seems to depend upon a retrocæcal position of the appendix. It is extremely important in these cases to determine whether or not there is radiation into the right thigh. This is not often found, but when present may be regarded as characteristic of true appendicular colic, since it never occurs in the ordinary pains of the intestinal peristalsis. Such radiation is not commonly seen in intestinal colic, but it does sometimes accompany painful affections in the female pelvis, and may occur in conjunction with distention of the cæcum with gas in neuropathic persons. In contrast to them, however, we have pains which are due to the localized peritonitis or peri-appendicitis, and these are situated more exactly over the position of the appendix.

On the other hand, it must not be overlooked that the severest appendicular lesions, even perforation, may exist without tenderness in the region of the appendix. Other regions may then be sensitive, however, for example above Poupart's ligament on the left side.

Extension of such processes and the formation of abscesses will lead to pressure pains in the right inguinal region, as well as to extreme tenderness upon rectal examination (abscess in the pouch of Douglas). These local peritonitic pains are very sharply defined, and are of extreme importance in differential diagnosis.

There are three principal elements which underlie the causation of pain in such conditions, which will have to be discussed in greater detail.

1. Pressure.—There is, almost invariably, pain upon pressure in the ileocæcal region corresponding to the location of the disease. This pain is subject to wide variations in intensity. It is usually greatest during the stage of abscess formation, when the abscess wall is subject to great distention. In such cases the slightest pressure, even the weight of the bed-clothes, will be marked by extreme agony. Pain upon pressure may occasionally exist in the right flank as well, especially in cases where abscess formation occurs retrocæcally. When the tenderness is situated high up under the right costal border, it is probable that the pain is chiefly of peritoneal origin. It has frequently come to my notice, however, that when the bowels have been freely moved by an enema (for instance, five grams of glycerin) the sensitiveness diminishes immediately upon reduction of the distention. This indicates unquestionably that the pressure of the distended intestinal walls upon their inflamed serous coverings may play an important rôle in the mechanism of these pains; this may also explain those less frequent cases in which the sensitiveness to pressure is greater over the left half of the abdomen above Poupart's ligament, than to the right, intestinal distention being more intense on that side. When the appendix itself is pressed upon, radiation of the

pain often occurs towards the epigastrium and into the left hypogastrium.

We have already considered the more or less traumatic pains produced by examination. Spontaneous movements of the patient produce pain in the same way, especially contraction of the abdominal and pelvic muscles. Thus the first pains frequently occur in the ileocæcal region when the patient stoops, sits down, sits up in bed, lifts a weight or bends the body back upon the hips. Sometimes even the lifting of the head when in the prone position will give rise to pain. More particularly, however, pain is caused by contracture of the right ileopsoas (produced by the bending of the right leg upon the hip). This motion gives rise to pain in the ileocæcal region, especially severe when the abdominal muscles are contracted. The pains, therefore, would be greater when the patient is standing, walking, or climbing stairs than when he is lying down, for in these positions the diseased tissues are compressed between the contracting ileopsoas and the contracting abdominal wall. It is important to remember this when testing pain on flexion of the right leg, for even during the existence of an appendicitis such motion of the right leg when the patient is lying down may be entirely without pain, while the same motion may be very painful when the patient is standing or walking. Thus this symptom of hip flexion is entirely dependent upon the position of the body. In some cases it can be elicited only when the patient is lying on his left side.

The first indication of appendicular pain has often occurred during the drawing on of shoes, and here again it is unquestionably a pressure pain, since the patient in carrying out this motion lifts the right leg and produces a contraction of the corresponding pelvic muscles. While this symptom is apparently trivial, it is so frequently the first indication of early appendicular trouble that it may become extremely important in differential diagnosis.

In some cases of early appendicitis the pain is markedly increased when the patient is lying on the right side, and this again is due to pressure upon the inflamed parts. Because of the pain caused by these muscular contractions, the patient involuntarily relaxes these muscles and thus many patients with appendicitis bend forward when walking or bend toward the right side, or, when lying down, draw up the right thigh and arouse by their very position the suspicion of appendicitis.

2. Jarring.—For diagnostic purposes the most practical way of producing jarring of the abdomen in the ilocæcal region is by percussion. With its help a very exact demarcation of the area of pain can be made, and it is much to be preferred for this purpose to simple palpation. The pathological basis of pain produced by jarring is probably the same as that of the pressure pains. Percussion in the mid-line is often more painful than on either side of the line because of the absence in this location of muscular defenses. Other forces which actively cause jarring of the abdomen are coughing, stepping on the right

leg in going downstairs, jumping, etc. In all these cases pains are produced in the appendicular region which are of a sharp, boring nature. This method of pain production is frequently possible before other symptoms have occurred.

3. Displacement.—Under this heading we will consider chiefly those tearing pains which are produced in certain positions of the body by the weight of the diseased organs. It is not surprising that the slightest displacement of its kind should cause pain when we consider that we are dealing with fresh inflammatory adhesions. This must be our interpretation of the pains complained of by patients who are unable to lie upon the left side, and who inform us that, in this position, they feel a painful drawing as though something were falling from the right to the left side. When the peritoneal process has extended into the left side the same variety of pain may be caused by the right-sided position. It is clear that such pains must be primarily influenced by two factors:

(1) The closeness with which the abdominal organs are held together. For instance, when the abdominal muscles are flabby and weak, and the viscera are in consequence very loosely packed together, even the slightest change of position will give rise to displacement.

(2) The formation of tumor in the ileocæcal region, either in the form of exudate or of enlarged glands. When the patient is lying on the left side the weight of the tumor mass will exert considerable

traction, a traction which may, however, be exerted by the weight of the intestinal contents themselves.

The pains described in the foregoing paragraphs are all referable to the localized peritoneal inflammation.

The general intestinal pains which are added to those of more purely appendicular origin are difficult of interpretation. It is not easy to say whether the basis of these lies in the appendix itself, or whether they are to be regarded as an accompanying intestinal colic. The localization of these colicky pains aids us but little in determining this. At any rate, it seems wise to restrict the term "appendicular colic" to those cases only in which, with other symptoms of appendicitis, sudden colicky pains occur spontaneously without reference to previous dietetic errors or other causes.

More frequently, however, the beginning of the colicky attacks is directly dependent upon intestinal disorders, especially those following errors in diet, and it would be hard to understand how such influences could affect the appendix itself since the pain very often appears within a few minutes of the ingestion of food. The fact that diarrhœa frequently occurs in these cases points to the likelihood that we are often dealing with an acute or an exacerbated chronic enteritis in the course of which changes in the appendix and its peritoneal surroundings may occur.

The diarrhœa is of great differential importance since it occurs frequently in early appendicitis,

whereas constipation is the rule in cases of lead colic, gall-bladder colic, and the pains of pyloric disease and diseases of the ureters. This is likewise true of most of the gastric pains (ulcer and hyperchlorhydria) which may in other respects have a superficial similarity to appendicitis. In this connection the gastric crises of tabes deserve mention since they are often accompanied by diarrhœa. Distention of the cæcum may give rise to pain which can be correctly interpreted only if the entire clinical picture is considered. The patients are usually neuropathic and have irritable digestive tracts. They complain of pain in the appendicular region that has existed for years, is not very severe and not associated with rise in temperature, but it appears during periods of constipation and is relieved by emptying the bowels. I have frequently elicited high pitched tympany over the cæcum in such cases. Abuse of tobacco seems to be a predisposing factor. The condition appears to be most easily explicable on the assumption of a distention of the cæcum, and if the appendix is removed the pain usually persists, or soon recurs. Such persons are undoubtedly predisposed to appendicitis and this must be taken into consideration in expressing an opinion as to the prognosis. Abnormal mobility of the cæcum does not appear to be of especial importance. In differentiating the condition from the ordinary acute inflammations of the small and large intestines, our most important aid lies in the localized peritoneal pains which have been spoken of above; of special impor-

tance is the hip-flexion symptom. Help may be derived from the bladder symptoms, which aid us in determining the existence of a local peritonitis. These often consist of pains during micturition; strong pressure is required to expel the urine, and occasionally retention of urine occurs.

In differentiating the intestinal pains produced by the ingestion of irritating substances or by flatus, we are aided particularly by the temperature. Functional enteralgia, as in mucous colitis, sometimes renders the diagnosis difficult. The following history illustrates this:

In December, 1907, I was consulted by an American banker, aged thirty years. For several years he had had attacks of colic low down in the abdomen, associated with tenderness on both sides and distention. Before the attacks began a tape-worm had been expelled. Immediately before the attacks *fœtor ex ore* was noticeable, and a fit of anger would be followed in about half an hour by an attack of the pain. There was no fever, but if the seizure was a severe one there would be slight chilliness. An enema given during an attack would bring away large quantities of mucus. The attacks were usually preceded by a copious evacuation, then one or two days of constipation, and then the attack.

Occasionally errors are made in cases where foreign bodies, introduced per os or per anum, give rise to a suspicion of appendicitis, the similarity being more marked because of the increased temperature.* It is often extremely difficult to differentiate appendicular pains from those produced in inflammatory diseases of the female genitals (parametrium, tubes, and ovaries); this is especially true because often

* *Cf.* page 66.

disease of the adnexa and appendicitis occur together. In such cases only a very exact analysis of the pains will lead to a correct interpretation.

The pains of peritoneal origin in both of these conditions show great similarity. In a general way however, the symmetrically bilateral location of the pain, and the deeper, pelvic position of the tenderness will point more directly to parametritis than to appendicitis. The influence of menstruation upon the pains must be carefully considered, without forgetting that it is not rare for adhesions to have formed between the appendix and chronically inflamed ovaries, and that the existence of a parametritis by no means excludes the existence of an appendicitis.

Furthermore in differentiating between these two conditions we may be guided by the fact that enteric pains are almost never present in diseases of the genitalia, and that the diet is entirely without influence upon the pain.

Appendicular colic may occasionally be simulated by right-sided ectopic pregnancy. During rupture, pain occurs which radiates into the right thigh and is accompanied by collapse and sensitiveness of the abdomen. The absence of temperature, however, the presence of acute anæmia, and occasionally bleeding from the genitals, with a previous history of pregnancy, and the discovery of a periuterine tumor, lead us in the right direction.

Occasionally we will have to consider in the differential diagnosis torsion of a right-sided ovarian

cyst, hydrosalpinx, etc. In women, too, in the absence of fever and leucocytosis, it is necessary to search carefully for signs of hysteria, especially in the abdominal regions (*viz.*, analgesia of the umbilical region). It is absolutely necessary, however, to analyze carefully the various factors which influence the pain in these cases, for, unquestionably, a true appendicitis may occur in an hysterical individual. Marked increase in the abdominal reflex * usually enables acute appendicitis to be excluded. When we consider that the appendicular pains are distinctly due to two components, on the one hand a local peritonitis, on the other hand a colic, it is plain that other inflammatory processes occurring in the ileocæcal region may give rise to the same symptom complex, chief among these being tuberculous, actinomycetic, and malignant processes. Similarly localized tenderness may occasionally occur in diseases of the kidney and gall-bladder, in psoas abscesses, in right-sided pleurisy, and in pneumonia. This, however, is usually most acute just below the right costal border. Psoas abscess must also be excluded, especially as it may be accompanied by a high leucocyte count.

LEAD COLIC.

When sudden attacks of colic occur in an anæmic individual who gives a history of dyspepsia, anorexia and constipation, and when these attacks are

* Best elicited by picking up and pinching a fold of skin.

localized in the epigastrium and are accompanied by retraction and rigidity of the abdominal walls, our first thought must be of chronic lead poisoning. On the other hand, it would be hasty to conclude from the coincidence of colicky pains and the signs of chronic plumbism that we are necessarily dealing with a neuralgia of the mesenteric plexus due to lead. Occasionally, other toxic conditions must be considered, to which patients with lead poisoning are particularly predisposed. Chief among these is nicotine poisoning. In cases of lead colic there is also a condition of general hypersensitiveness, and the patients, like the neuropathics, tend to exaggerate their symptoms. It is not rare, also, to find tuberculosis in individuals with lead poisoning, and in such cases we may well be dealing with tuberculous ulcerations. Again, ulcerative processes in the stomach and duodenum are not infrequent during the course of lead poisoning, and may be especially favored by the condition of the vessels and by a tendency to spastic contraction in the stomach and intestinal canal. On this account chronic plumbism and duodenal ulceration are sometimes associated. Furthermore, I should like to call attention to the fact that in cases of chronic lead poisoning there is sensitiveness to pressure in the region of the appendix, and for this reason also the question of appendicitis must be considered. It goes without saying, furthermore, that chronic lead poisoning does not protect against the colics of gall-stones and renal calculi. It becomes necessary, therefore, in each case, to

consider carefully the individual symptoms and to analyze the pains as they occur.

In regard to the factors modifying the pains we can assume that, because of the nervous origin of the disease, dietetic influences do not come under consideration; and, as a matter of fact, this conclusion is justified by actual fact. The pains in this condition are independent of dietetic influences. This is in contrast to the state of affairs found in the case of most intestinal pains (tuberculous ulcerations and stenosis of the gut) and therefore is of the greatest differential importance. It would, however, be silly to expect that the hyperæsthetic gut of chronic lead poisoning may not react forcibly to errors of diet, and all those articles of food which cause much flatus may in these cases give rise to true colic. This, of course, would not represent a true case of lead colic, but would simply consist of a colica flatulenta favored by the existing lead poisoning. It is probable that in a great many cases of so-called lead colic the pains are caused by the presence of stagnated fecal material and abnormal quantities of gas, and thus are explained the frequent prompt results gained therapeutically by high enemata, and the observation frequently made by patients that the passage of gas immediately relieves the colic; in some cases, too, relief may be experienced from vomiting.

Excessive use of tobacco is unquestionably an important factor in the initiation and increase of the colicky pains, a consideration which is worthy

of notice therapeutically. Alcohol in concentrated forms, such as brandy, in many cases causes diminution of the pains. Mechanical agencies, because of the neuropathological basis of the pains, have little influence.

Changes of position do not influence the pain in these cases as they do in ulcerative processes or in the localized peritoneal inflammations. It is frequently claimed that pressure upon the abdomen is not painful in cases of lead colic, but on the contrary often relieves pain. This is true in a great many instances, but cannot be regarded as a rule. Pain on pressure may frequently be due to the fact that there exists a severe neurasthenia which is accompanied by general hyperæsthesia. In those cases where gas collects, locally or diffusely, in the intestinal tract during the attacks, it is perfectly natural that there should be a certain amount of tenderness to pressure over the distended intestinal coils. The sensitiveness of the abdomen to pressure, therefore, can give us little help in differentiating this condition from the peritoneal processes. Flexion of the thighs upon the abdomen frequently gives relief; but it is important to notice whether both thighs are flexed or whether the right thigh simply, as would be the case in appendicitis or in the tuberculous ulcerations of the intestine.

The application of heat usually influences the colic favorably. The application of cold often initiates an attack. Emotional excitement may frequently give rise to a severe attack of pain.

The pains, which are chiefly of a sharp, boring or cutting character, and which are almost invariably paroxysmal, are located principally about the umbilicus. Occasionally, however, they occur in the epigastrium. When the attack is at its height it is hard to refer pains to any particular region, and they may cover the abdomen diffusely. The pain is as a rule limited to the abdominal region and only in the rarest cases radiates into the sternum, the chest and the shoulders. On the other hand, pain frequently occurs in the lumbar region, and may radiate into the genitals or bilaterally into the thighs (lead colic of the ureters). This latter form differs from the ureteral colic due to stone in being bilateral. It is important to bear this possibility in mind, for in consequence of the lead nephritis the urine may contain red blood-cells.

A wood turner, aged forty-six years, came under observation in December, 1909. For years he had used a polish consisting of shellac and white lead, and the air would be filled with dust from the lead pigments employed. Remains of the polish were found about his nails and there was a lead line on the gums. As long as twenty-two years ago he had had attacks of abdominal cramps with vomiting and constipation. The attacks at first occurred once a month. Two years ago he had a very severe one, and then there was a remission until four days before admission, when there was sudden, severe, cramp-like pain in the epigastrium with vomiting. At the height of the attack there was radiation of the pain into both testicles and down the thighs to the knees. There was vesical tenesmus, but the urine was voided only drop by drop. The abdomen at first was hard and tender. During the attacks he could not take solids, acids, or cold drinks. The urine contained traces of albumin and of blood pigment and the sediment showed a few granular and epithelial casts.

There is no radiation into the ileocæcal region, as is so frequently the case in tuberculous ulcerations. This region, however, and occasionally the situation of the sigmoid flexure may be quite sensitive to pressure. This can be easily explained by the fact that in these two regions especially there is apt to be stagnation of the fæces which, with slight inflammatory changes, leads naturally to tenderness.

As far as the time of occurrence of these pains is concerned we are able to gather no facts of differential importance. The very irregularity of the attacks, which often show prolonged intervals between separate seizures, should give us some clew. Attacks occur more frequently during the night than during the day; but this peculiarity is common to all varieties of abdominal colic.

The most important of the secondary symptoms which accompany the colicky attacks are the following. Nausea and vomiting, often an absolute intolerance for solid or fluid food, constipation preceding the attack, sometimes with tenesmus, usually with retraction of the abdominal wall. Visible peristalsis and succussion are rarely present, and are found only in those cases where the constipation is of a very chronic order and where the abdominal walls are extremely flabby. There are practically no alarming general symptoms. The diagnosis, of course, will be much strengthened by the discovery of other symptoms of chronic lead poisoning, such as a lead line, weakness of the muscles supplied by

the radial nerve, and high blood pressure. The high blood pressure itself is by no means constant in these cases, since it may even be diminished in cases where the anæmia is severe or where tuberculosis exists as a complication.

There are other conditions which, resting on a purely neuropathological basis, may also produce gastro-intestinal colic, and from these we must occasionally differentiate lead colic. Chief among these, of course, would be the intestinal crises of tabes, and in such cases the nervous system must be carefully examined in order to make the differentiation. The crises, however, differ from lead colic in their frequent association with diarrhœa.

Ulcerations of the gut with stenosis may give rise to difficulty in diagnosis. Lead colic is excluded in such cases by the close relation of the pains to the taking of food, their constancy, and their definite variation upon changes of position. The discovery of sarcinæ in the vomitus or the fæces during an attack would point quite distinctly to the existence of pyloris stenosis. If, as sometimes happens, lead colic is associated with catarrhal jaundice the differentiation from cholelithiasis may be very difficult. The possibility of confounding the condition with nephrolithiasis has already been mentioned.

In distinguishing lead colic from appendicitis and peritonitis, our chief strongholds are the afebrile course and the absence of a leucocytosis. These two conditions carry with them also voluntary immo-

bilization of the abdomen and the patient usually assumes a supine position, whereas in lead colic the constant restlessness is characteristic, and the patient may walk about or remain in a sitting position, pressing his hands upon his abdomen. The indifference of the patient to mechanical disturbances of the abdomen is quite characteristic and helps very much in differentiating lead colic from other conditions. This aid is lost, however, in those cases mentioned above of neurasthenic patients, who occasionally show abdominal sensitiveness.

In closing, it is necessary to call attention again to the fact that, even when chronic lead poisoning can be definitely diagnosed, the possibility of a complicating gastric ulcer or renal calculus must not be overlooked.

MALIGNANT NEW GROWTHS OF THE INTESTINE.

There is nothing absolutely characteristic about the pains occurring in the conditions we are about to discuss. They may be caused by organic changes and mechanical stenosis of the gut, and the distention and increased peristalsis dependent upon these. Or, again, their pathological basis may rest chiefly upon peritoneal involvement. The pains are important, nevertheless, from a diagnostic point of view, in that they frequently occur during the very early stage of the condition when other physical signs are entirely lacking.

These pains are frequently regarded as harmless

manifestations of intestinal indigestion such as follow errors in diet or exposure to cold, and yet if the phenomena of the pains are carefully analyzed we may often find distinct reasons for believing that there is a well-localized cause for the attacks. Whenever this can be accomplished an important diagnostic advance has been made. In dealing with persons beyond middle life, with no past history of digestive disturbances, the significance of attacks of intestinal colic should never be underestimated, and under these conditions the stools should always be carefully investigated for the possible presence of occult blood.

Corresponding with the localized process from which they arise, there is a tendency in such cases towards a localization of the pains. This is particularly true of the neoplasms of the large intestine where frequently, at the very beginning of the attacks, the pain is felt in the seat of the lesion, and, in consequence, usually occurs in the cæcum or in the three flexures of the large gut. At the height of such an attack the pain is generally diffuse, but centers chiefly in the region of the umbilicus, and is frequently accompanied by pain in the lumbar regions. Whenever the obstructing process lies in the neighborhood of the splenic flexure there may be distinct radiation into the lower half of the thorax and occasionally, though rarely, into the left leg (one case of hysteria). When the neoplasm occurs in the hepatic flexure the condition may strikingly simulate gall-bladder colic. The pains begin in the neighbor-

hood of the gall-bladder, radiate backwards into the small of the back, and frequently reach even to the right shoulder blade. Radiation towards the anus is a phenomenon of extreme importance, for it indicates most frequently a deep-seated carcinoma of the sigmoid flexure. Occasionally it may accompany new growths which are situated higher up in the colon, but whenever it is present it appears to the writer to be a most important sign of stenotic processes in the large intestine. In carcinoma of the sigmoid flexure and rectum a more distinct localization can often be made. When the process is situated in these regions there are frequently dull pains in the left inguinal region which radiate into the left testicle. Again pains may arise in the left half of the epigastrium and radiate towards the anus; radiation into the left inguinal region and along the outer aspect of the left thigh occurs and seems to be a particular accompaniment of left-sided tumors. Pains in the back are rarely present, or when occurring are simply added to the sum of the other pains. The same may be said of pains in the region of the left sciatic nerve.

Not less important than the topographical considerations are those symptoms which give us a clew to the factors influencing the pains, and these aid us particularly in differentiating the localized carcinomatous processes from those occurring in acute or chronic enteritis.

It appears to me of special importance, whenever intestinal colic occurs in older people, to deter-

mine whether there is a "position of the greatest pain," such as that which we have considered in the discussion of the pains accompanying ulcers (*v.* page 161). When we are dealing, for instance, with a carcinomatous process in the region of the hepatic flexure patients will frequently tell us that they cannot lie comfortably upon the left side because in this position they have pains in the right side which give them the impression of a mass dropping from right to left. This is unquestionably in many cases due to traction upon peritoneal adhesions and therefore points strongly towards the extension of a local process. The occurrence of such an extremely important diagnostic position of pain is not infrequently noticeable at an earlier stage than the occurrence of any local sensitiveness to palpation. It is always important to examine the abdomen carefully for sensitiveness to local pressure, since in many cases pains may be produced in this way, which then give an important clew. Absence of abdominal tenderness does not, of course, exclude absolutely the condition under consideration, for sensitiveness to pressure may be absent in those neoplasms which are situated in the pelvis, in the neighborhood of the rectum and in the lower half of the sigmoid flexure. Local sensitiveness corresponding to the seat of the tumor is occasionally felt during strong contraction of the abdominal muscles, such as that produced by lifting a weight or in defecation. Deep diaphragmatic inspiration may give rise to such pain, especially in cases where peritoneal inflammations are

present. The same kind of pain may be elicited by careful inflation of the rectum. Whenever pains are present in the lumbar region these are increased by stooping.

The peculiarities of the pain in cases of malignant tumors which we have so far enumerated, have a diagnostic significance chiefly because they lead us to suspect a localized cause for the attacks of colic, and therefore considerably limit the diagnostic field. For, by reaching such a conclusion, we are able to exclude a great many of the more generalized causes for intestinal colic, such as the conditions caused by flatulence and the ordinary intestinal indigestion. The differentially significant phenomena in the case of neoplasms are based upon the early occurrence of a local peritonitis, giving rise to the occurrence of a position of the greatest pain, and to local sensitiveness. No specific or characteristic factors, of course, can be ascribed to those phenomena which depend upon flatulence and consequent distention of the gut, or upon the increased peristaltic contractions of the intestinal muscles. If the symptoms depending upon these conditions are particularly prominent they lead easily to confusion with other conditions. However, these general pains will aid very much in differentiating the conditions we are speaking of from colicky attacks occurring with diseases of other organs. This would be particularly important in cases such as carcinoma of the hepatic flexure where the confusion with gall-bladder colic is very easy, and where such general

intestinal symptoms protect us from mistaking one condition for the other. This becomes especially significant when we consider how frequently even the secondary symptoms of these two conditions (fever and slight jaundice) are common to both.

When, in intestinal new growths, the attacks of pain are dependent chiefly upon the general intestinal condition, their onset may frequently be directly related to some thermic stimulation, such as the application of cold, walking with bare feet upon a cold floor, sudden throwing off of the bed-clothes or drinking cold fluids. The reason for this is a stimulation of peristalsis. Again, the attacks of pain may be incited by articles of diet which increase the production of gas in the intestine, such as certain vegetables, bread, etc., and frequently in the history of intestinal carcinoma the first attack of pain is directly referable to such errors of diet. It is well to remember these things in order to protect ourselves against mistaking the early symptoms of a carcinoma for simple intestinal colic, and it is especially desirable when dealing with older individuals to search carefully for the existence of a new growth even when the colicky pains seem to have been directly connected with an error in diet.

It frequently happens that the positive physical signs are delayed for a long period after these first subjective symptoms have been noticed. In those cases where the above-mentioned subjective symptoms are absent, but where we have some other reason to suspect the existence of a neoplasm, it is

well to attempt by palpation and by changes of position to produce artificially the conditions most favorable to the production of the pains; and in this way we may be led to a clearer comprehension of the case.

An important symptom which is frequently present in these cases is prolonged constipation. The passage of feces or gas from the intestine is usually followed by an immediate diminution of the pains. The patients themselves frequently, during the attacks of colic, massage the abdomen in the region corresponding to the position of the tumor in order to diminish their pains. Thus the distribution of the distention which is probably the cause of the pain actually leads to great relief. Occasionally, even, the definite localization of the spontaneous massage carried on by the patient will be of diagnostic aid.

While there is generally no distinct relation between the attacks of pain and the taking of food, occasionally there does exist some regularity in their occurrence in relation to the large meal. In some cases attacks occur within two to three hours after the meal, and are probably directly dependent upon the occurrence of powerful peristalsis during this time. This same interpretation may be given to the frequency of nocturnal attacks. During early carcinoma there are usually intervals of several months between the attacks of pain. As the disease progresses the intervals become shorter and shorter, a fact which may have much diagnostic significance,

since these intervals depend upon the nature of the process. Frequently the pains occur a short time before defecation. This is chiefly the case in those carcinomata which are situated well down under the sigmoid flexure.

The symptoms which occasionally accompany the pains due to intestinal neoplasms are often of such a nature that their erroneous interpretation might well lead to false localization of the disease in the stomach, the gall-bladder, the kidneys, etc. Thus vomiting is frequently present at the height of the attack, and, with it, appear epigastric pains. The suspicion of gastric disease aroused by these symptoms can be allayed by remembering that whenever vomiting occurs in intestinal neoplasms we may presuppose a considerable degree of stenosis and may, therefore, expect such vomiting to be accompanied by visible or palpable intestinal peristalsis. When the vomitus is bile-stained, is foul, or contains B. coli, we will, of course, be led to recognize the intestinal character of the condition.

In carcinoma of the splenic flexure pains frequently occur immediately after the taking of food, and are caused either by inflammatory adhesions to the stomach, or by direct invasion of that organ. In such cases careful distention of the rectum will usually give rise to immediate pains in the region of the splenic flexure. The pains of carcinomata of the hepatic flexure are frequently confused with gall-bladder colic, especially when the pain is localized over the gall-bladder, because of adhesions or

direct metastatic growth. Icterus is often present in these cases, and a sensation of resistance in the neighborhood of the gall-bladder may be felt. In such cases, as we have mentioned before, especial attention must be paid to the influence which the application of cold exerts upon the production of peristalsis and to the presence of visible peristalsis or succussion in the ascending colon. The tendency to diarrhœa, the occasional foul stools containing mucus, and the presence of blood or of an abnormal flora in the feces, are additional evidences pointing to carcinoma. The local bulging which might occur in the neighborhood of the gall-bladder when the intestine in this vicinity is abnormally distended could very easily be misinterpreted as a large gall-bladder. Chills occur in this form of intestinal carcinoma also, just as they occur in gall-bladder colic. In some cases, especially in carcinomata of the sigmoid flexure or the cæcum, difficulty in urination, pain in the bladder, frequent micturition, and even radiation into the testicle may be present, and these may easily lead to false conclusions. In this connection it is simply necessary to remember the danger of error and to avoid it whenever the tumor is impalpable and visible peristalsis is absent by careful examination of the stools and the peculiarities of defecation, such as tenesmus and distention of the descending colon.

In differentiating carcinomatous disease of the intestine from the other more distinctly enteric causes of colic (flatulence, intestinal indigestion, etc.)

we have already called attention to the fact that a careful analysis of the pain alone may give us much basis for a sharp localization of the pathological condition. A distinct recognition of this, if we consider the relatively limited number of such localized processes in the intestinal tract, will make the further differential diagnosis quite simple, for there are few ulcerative or stenotic conditions with well-localized symptoms which are of practical importance. Thus, in the ileocæcal region we have, outside of carcinoma, to deal almost exclusively with tuberculosis; in the sigmoid flexure, almost exclusively with dysentery or occasionally membranous enteritis.

LIVER.

There are three chief factors which give rise to pain in the region of the liver. These may be discussed in three groups, as follows:

I. Conditions of Spasm or Distention in the Bile-passages and Gall-bladder.

The pains occurring in this region are closely analogous to those occurring in the gastro-intestinal tract—a fact which is not surprising when we consider the great similarity between the two systems functionally and anatomically. As in the intestinal tract, a simple narrowing in the system of bile ducts is followed by spasm and overdistention in front of the stenosis, which consequently give rise to colicky pains. Thus here, too, colicky pains may be caused without absolute anatomical occlusion of the lumen.

While such attacks of gall-bladder colic are usually associated with the presence of gall-stones, this is not by any means necessary, and it is illogical to speak invariably of such attacks as gall-stone colic.

Further analogy to the conditions in the alimentary canal is found in the fact that inflammatory processes without any existing organic stenosis may be accompanied by the same attacks of pain, the conditions for such attacks being especially favorable in the appendix to the gall-duct system—the gall-bladder. Here a colicky attack may be initiated by an inflammatory exudation with a rapidly increasing intravesical pressure and overdistention of the walls. In discussing the conditions in the biliary system which can give rise to spasms and overdistention, with their consequent attacks of colic, we shall have to consider:

(a) Stenosis due to carcinoma at the papilla of Vater or in the head of the pancreas, ascarides in the ductus choledochus, aneurysms of the hepatic artery, intrahepatic carcinoma, cysts and gummata, kinking of the cystic duct in enteroptosis by adhesions, etc.

(b) Inflammation, as in cholangeitis with or without biliary cirrhosis, acute yellow atrophy, cholecystitis with or without the formation of stones, carcinoma, etc.

It is hardly necessary to mention that occasionally attacks of colic may be initiated by a combination of (a) and (b). It is a universal rule that wherever secretions accumulate because of the formation of a stenosis the opportunity for infection

and for the development of a "stagnation-flora" is particularly favorable.

It would probably be very advisable to drop the expression gall-stone colic entirely, and to substitute for it the words gall-bladder colic or gall-duct colic, terms which imply no premature anatomical diagnosis. This may seem pedantic, because in the majority of these cases stones are actually present, but this slow method of diagnosis seems to the writer extremely desirable, since by its use we may often avoid overlooking other and rarer causes for these attacks.

II. Distention of the Liver Capsule.

Whenever a free flow of blood out of the hepatic veins is prevented, a swelling of the liver results which leads to painful distention of the peritoneal coverings. A similar condition is caused by obstruction to the flow of bile. The presence of cysts in the liver tissue, and the growth of neoplasms, may give rise to a similar result. Distention of the capsule of the liver may also be produced by active hyperæmia. Thus in malaria, pernicious anæmia, paroxysmal hæmoglobinuria, leukæmia, diabetes, this occasionally occurs. In the last-named condition, however, the sensitiveness to pressure is usually of very moderate degree.

III. Inflammatory Processes in the Capsule of the Liver (Local and Diffuse Perihepatitis).

The general diagnosis of a hepatalgia is based chiefly upon the discovery of sensitiveness to pres-

sure or percussion, upon the size of the organ as determined by the liver dullness and upon a close analysis of the subjective pains.

It now becomes our task to analyze more closely the details of the mechanism of these pains. In doing this we shall find that the groups which we have just discussed will often act in combination.

I. Gall-bladder Colic.

It is plain, from the very pathological conditions underlying the pains occurring in diseases of this organ, that the general phenomena must frequently be of an extremely complicated nature. Thus, adhesions between the gall-bladder on the one hand, and the duodenum or colon on the other, may give rise to entirely independent attacks of pain; the development of peritonitis, the occurrence of septic thrombosis in the lower extremities, with the pains that occur in them simulating radiation from the original seat of trouble, offer extreme difficulties to interpretation. It must also be remembered that, at the height of the attacks, neurasthenic patients may experience most unusual radiations of pain into the left arm or into the right leg, so that in judging of the condition it is especially important to pay attention to the pains which have occurred at the very beginning of the attack.

The usual locations of the earliest pains are in the epigastrium, in its middle portion or just below the right costal margin. Whenever the attack of colic is localized chiefly on the left half of the epi-

gastrium we will be much more apt to think of a simple gastralgia (excepting, of course, in cases of transposition of the organs). The natural explanation of this right-sided position of the pain is found in the topography of the gall-bladder and the liver.

The pain most usually radiates from the epigastrium upwards, in rare cases up to the right half of the neck and to the right acromion process. More often, however, it radiates, in front, up to the right nipple and backwards into the shoulder blade and into the right lumbar region. The radiations which occasionally occur into the right arm and leg, or even into the left arm, are present only at the height of very intense attacks of colic, and only in patients who are of unusually neurotic constitution. The paræsthesiæ which occur occasionally in the arms are probably of a vasomotor nature. Whenever the radiations into the left arm are prominent we must consider the possibility that the attack of gall-bladder colic by increasing the blood pressure has brought on secondarily an attack of true functional or organic angina pectoris.

Radiations into the genitals with retention of urine and severe pains above the symphysis occur but rarely, but when they do occur usually depend upon the development of the peritonitis which occasionally accompanies the gall-bladder inflammation; pains in the lower extremities, especially those which occur in the nerves of the legs, are frequently due to septic thrombi. Such complications must be very carefully considered in order that we may avoid any

confusion with renal calculi. It is only at the very height of the attacks that the pains are diffuse or lack definite localization.

While the localization of these subjective pains is extremely important, just as much help can be obtained by a careful determination of those areas which are tender to palpation and percussion.

1. The Gall-bladder Itself.—This organ is often enlarged and is usually markedly tender to palpation and percussion. There are certain peculiarities connected with this tenderness, the presence of which confirms the diagnosis of gall-bladder tumor and aids in distinguishing it from the lower pole of the kidney. Pressure upon the gall-bladder frequently produces radiation of the pain along the phrenic nerve towards the acromion. Radiations backward towards the left half of the epigastrium and towards the ensiform process are quite frequent. This artificially produced radiation is an important adjunct to the spontaneous radiations.

2. The Mid-line of the Epigastrium from the Ensiform to the Edge of the Liver.—In this region, corresponding to the area of liver dullness, limited below by the edge of the liver, there is in almost all cases of early gall-bladder colic marked tenderness to percussion. In those cases which are accompanied by icterus, this tenderness may remain for a long while after the end of the attack of colic and may, by its diminution, indicate an improvement in the accompanying pathological changes. This symptom of tenderness to palpation in the mid-line which

occurs in cases of gall-duct colic is directly referable to increase of intrahepatic pressure, and will receive further attention in the section on hepatic congestion.

3. The Right Lumbar Region (Limited Above by the Base of the Lung).—Here we are dealing with a symptom which frequently remains for some time after the attack proper has ended, and has probably the same etiological causes as the symptom just described under 2. In order to determine the presence of this symptom it is best to tap lightly with the ulnar surface of the fist upon both lumbar regions in order to compare the tenderness of the two sides.

In addition to these well-localized areas of pain there are other varieties of pain which undoubtedly are of reflex origin (phrenic nerve, etc.).

(a) Tenderness in the area of the shoulder girdle. There is great tenderness to pressure in the right brachial plexus; this symptom is rare. More frequently there is a point of sensitiveness situated along the upper portion of the trapezius muscle, about three fingers' breadth distant from the acromion. Pressure at this point causes pain which radiates towards the gall-bladder. Pressure upon the gall-bladder, on the other hand, may cause pain radiating towards this point. There exists thus a mutual radiation from one point to the other.

The pains we have just discussed are not frequent in their occurrence, but when they are present they may be of considerable importance in differen-

tiating these conditions from other similar attacks of colic, such as those of pyloric stenosis, etc. They are also found, however, in cases of liver abscess, and in general in all cases of subdiaphragmatic inflammations.

(b) Tenderness to palpation along the vertebral column. There is no localized tenderness over any one particular spinous process. The hyperæsthetic zone extends usually over several spinous processes and is commonly subject to great variations, but, in general, it occurs between the fourth and the twelfth thoracic vertebræ. Occasionally there may be tenderness to pressure in the ileocæcal region. This, when present, is not easy to interpret. Probably in most cases it is a direct transmission of the pressure upwards, and thus in reality a true gall-bladder pain. On the other hand, we must remember that in patients with gall-stone disease, and liver disease in general, there are usually intestinal disturbances, chiefly chronic constipation, and it is necessary for us therefore to think of chronic inflammatory conditions of the appendix.

In order clearly to differentiate between gall-bladder colic and attacks of paroxysmal pain from other causes, it is necessary to pay very close attention to the gradual increase and decrease of the attacks and to the cramp-like, sharp character of the pain. In those cases in which stone formation is present this characteristic of a rapid rise to a climax and gradual decrease, is especially marked, and the intensity of the attack seems to reach its

maximum at the time when the stone is expelled. This peculiar intensity of the pain is *par excellence* a characteristic of biliary colic, and is frequently of service in the differential diagnosis. There are cases which have a more chronic and latent character and which in the course of years may have no sharp attacks, but in which there is a constant sensation of soreness in the epigastrium. Such cases of gall-stones without actual colic usually occur together with enteroptosis, and these run their course with constant paræsthetic sensations in the region of the epigastrium. Weakness of the abdominal muscles, as well as relaxation of the musculature of the gall-ducts, may be responsible for this.

The attacks of colic may occasionally be preceded and followed by pains of another nature. These are usually sharp, cutting sensations which are directly dependent upon deep breathing and coughing, and which are due to inflammatory changes about the gall-bladder. In these cases auscultation may reveal a leather-like creaking over the gall-bladder, and the patient may have the sensation of distention of the gall-bladder or stomach.

As regards the influence of the taking of food upon the attacks of gall-bladder colic, we may say that a marked contrast exists between this condition and cases of pyloric stenosis. There is no injury done to the affected parts by the food, as is the case in gastric ulcer, and peristalsis of the gall-ducts, if at all excited by the taking of food, is certainly not so deeply influenced as is intestinal or gastric peristalsis. We may thus say that, in these cases, the

relation of the taking of food to the beginning of an attack is entirely unimportant, and, as a matter of fact, this is true in all those cases where cholelithiasis occurs in patients of otherwise normal gastro-intestinal tracts. The taking of food is important in relation to the attacks only in those cases where we are dealing with delicate, anæmic individuals, often with some degree of enteroptosis, especially those with gastroptosis and general atony of the stomach. These cases are chiefly limited to the female sex, and in them a differential diagnosis between a gastric condition and gall-bladder colic is extremely difficult.

It is not at all out of the question that in some of these cases following an error in diet, a gastralgia with cramp-like contractions of the stomach is started which may secondarily give rise to an attack of colic in the gall-ducts, the muscular activity of the two systems being functionally so closely allied. The influence of diet upon gall-duct colic is similar in many ways to its influence upon the pains of pyloric stenosis, and it is not at all unlikely that, accompanying some cases of gall-stone, there actually does occur slight obstruction at the pylorus or in the duodenum itself. On the one hand, gastroptosis, which is so often present, may readily lead to kinking of the duodenum and subsequent stenosis; on the other, it is not infrequent to find adhesions between the pylorus and the gall-bladder which may cause similar obstruction.

The articles of diet which are especially apt to be responsible for the attacks are all those which lead

to distention, vegetables, carbohydrates, bread, etc.; also fat, meat, cheese, acid food, beer, etc. Attacks are occasionally inhibited by strong alcohol in the form of brandy. Antineuralgic drugs act well during the attack in those cases in which there is a general neuropathic substratum and there are no complications due to infection. The quality of the food is often less important than the quantity, in that the attack is initiated simply by the mechanical overfilling of the stomach.

Just as in the case of the pain accompanying ulceration of the pylorus, in these cases the position of the patient has an important influence upon the course of the attacks. The pain is especially severe when the patient is lying on his left side. In this position he may complain of a drawing sensation which gives the impression of something being tugged from the right hypochondriac region toward the left. This pain, in the left-sided position, is especially severe whenever there is great flabbiness of the abdominal walls, and therefore corresponding mobility of the abdominal organs. Mechanically the explanation is extremely simple, since in this position the swollen organs are freely suspended from their inflamed peritoneal attachments. It is true that in some cases there is pain also in the right-sided position, and this is easily explained by the fact that greater pressure is exerted upon the liver and gall-bladder; but when this does occur the pain is not accompanied by nausea and belching, as is

almost invariably the case when the right-sided pains occur with ulceration and stenosis of the pylorus.

Inflammatory changes in the neighborhood of the gall-bladder and in the serous coverings of the liver give rise to other secondary symptoms. Thus the jarring accompanying speech, rapid walking, running down hill, coughing and sneezing, gives much discomfort during the attack and for a long time afterwards. Likewise those motions are very painful which are accompanied by pressure upon the abdominal organs in general, such as stooping, putting on the shoes, lifting a weight. Bending forward occasionally causes pain in the back, and owing to this the patients often instinctively relax their abdominal muscles by walking in a stooping position or shoving a pillow under their backs. In thin persons with enteroptosis movement is particularly likely to induce pain, and in these cases rest in bed is certainly indicated. Cold may sometimes incite attacks.

I have seen patients who believed that cold air striking the epigastrium brought on their pain, and who were accustomed to guard against this by wearing a pad of cloth or cotton wadding over the upper abdomen.

Like the stomach and intestine, the gall-bladder has an important functional dependence upon the central nervous system, and it is thus not surprising that observations have been made which would indicate that attacks of gall-stone colic have been initiated by psychic or emotional impulses.

It is at least worth considering whether such attacks cannot be reflexly initiated from other organs, the kidneys, the genitals, the stomach, or the intestine, either in the presence of gall-stones or with any other lesion of the bile passages. Abnormal irritability of the nervous system may certainly also come into question as a factor favoring the attacks.

In one case of undoubted cholelithiasis under my observation menstruation was always accompanied by tenderness over the gall-bladder.

There is a little definite connection between gall-stone colic and conditions of obstruction in the alimentary canal. Thus, prolonged constipation may occasionally start an attack, probably by preventing the free expulsion of bile, and occasionally an attack of colic may be interrupted by a free evacuation of the bowels by enema or otherwise. Such close interrelation is logically to be expected when we consider the intimate functional relationship that exists between the intestine and the bile passages.

As regards the time of attack, there is unquestionably a greater frequency during the night or evening, but this is not striking and attacks may occur at any time during the day. Severe abdominal cramps coming on shortly after parturition are not infrequently due to cholelithiasis, and this point is a useful one to remember in making a differential diagnosis.

In differentiating gall-stone colic from pyloric stenosis, we may be helped by remembering, first, the long, free intervals occurring between attacks of the former condition, in contrast to the almost uninterrupted suffering of the latter. When attacks occur daily for weeks we may usually conclude that we are dealing with stones which are immovably lodged in the cystis duct or with one of those cases of enteroptosis mentioned above. Stones which are situated further down, in the less narrow common duct, usually give rise to comparatively little peristaltic unrest in the gall-duct system and consequently are less productive of pain.

The most important of the secondary symptoms which are to be considered is vomiting. This symptom especially may lead to confusion in pointing towards a gastric condition, such as ulceration at the pylorus; but the character of the vomiting is quite different in the two conditions. In the case of pyloric ulceration or stenosis the vomiting is usually very copious, does not consist of bile, has a sour taste, and is usually followed by immediate relief from pain; in gall-stone colic it is usually full of bile, is bitter in its taste, and in most cases increases the pain because the general disturbance of the act, as well as the pressure of the abdominal muscles, causes considerable pain in the sensitive liver and gall-bladder.

If the physician is present during the attack, examination of the urine will quickly determine

whether obstruction of the bile exists or not. Such a decision is much more difficult when we have to make up our minds simply by means of the statements of the patient. We must not lay too much weight upon the patient's statement that his urine was dark during the attack, for in the attacks of the colic of gastric ulcer we often notice the excretion of a dark concentrated urine. If the patient is able to tell us that the urine has left yellow marks upon the linen or that there has been pruritus, the likelihood of the existence of true icterus becomes very strong. In exceptional cases cholelithiasis may be accompanied by hæmaturia, and is then due to an associated hemorrhagic nephritis. While it is true that jaundice is occasionally absent in diseases of the liver and, on the other hand, is often present in other diseases, such for example as gastric and appendicular disease, in duodenal ulcer and in carcinoma of the hepatic flexure; nevertheless too much importance cannot be attached to this point, and, when icterus has never been present in patients whose disease has existed for a considerable period, extreme caution must be used before a diagnosis of hepatic disease is made.

Shaking chills and rise of temperature are frequently present during the attacks themselves, but are of much less importance than increased temperature which is present for some length of time after the attacks. The chills and rise of temperature during the attacks may be present in many other conditions in persons who have irritable vasomotor sys-

tems. The temperature which occurs after attacks, however, is usually an expression of an infection, such as that which is frequently present in gall-bladder colic, and is therefore of much more importance in clearing up the diagnosis. Herpes is rarely present.

The symptoms which appear on physical examination are chiefly tumor of the gall-bladder and liver, creaking friction sounds over the gall-bladder, crepitant râles over the base of the right lung, and occasionally also over the base of the left lung (splenic enlargement).

There are a number of conditions which may simulate gall-bladder colic. Chief among these are:

1. *Cicatricial and ulcerative processes of the pylorus* (see page 185).

2. *Duodenal Ulcer.*—The localization of the attacks may be very similar in the two conditions. In a general way the same distinguishing characteristics may be drawn between these two conditions as are useful in differentiating gall-bladder colic from pyloric stenosis. In duodenal ulcer there is almost immediate relief after vomiting because of the evacuation of the distended stomach.

3. *Appendicitis.*—The danger of false diagnosis is especially due to the fact that many cases of cholelithiasis show tenderness to pressure in the ileocæcal region; this is usually caused by an abnormal position of the gall-bladder on account of a sinking and rotation of the liver.

In a great many cases also there may be a chronic inflammatory process of the appendix directly re-

lated to the chronic constipation accompanying gall-stone disease. A superficial examiner might therefore easily misinterpret attacks of colic with sensitiveness in the ileocæcal region as appendicular colic. On the other hand, cases of true appendicitis may simulate gall-stone colic when the appendicular pain is situated high up, because of an abnormal position of the appendix. Careful analysis of the pains, together with most painstaking examination of the liver for enlargement, tenderness, etc., can alone give us clearness.

4. *Carcinoma of the Colon.*—Another condition which it is difficult to differentiate from the pain under consideration is carcinoma of the hepatic flexure of the colon, with adhesions to the gall-bladder and liver. In these cases there are colicky attacks with localization and radiation similar to those of true gall-stone colic. Added to these, slight jaundice is present, due to adhesions to or metastatic infiltration of the bile passages. The difficulty may be further increased by the presence of a rounded sensitive tumor which cannot be separated from the liver.

While the examination of the feces and other subjective signs will clearly differentiate these conditions, the writer would like to call attention, for the purpose of rapid diagnosis, to the great difference which exists in the reaction of the pains of these two conditions to thermic influences. Whenever the attacks of pain are easily brought on by the application of cold (cold drinks, exposure of the

abdomen, etc.), gall-duct colic is extremely unlikely, this characteristic being peculiar chiefly to the paroxysmal pains occurring in the intestines.

Rises of temperature occur in ulcerating carcinoma of the colon and therefore give us no differential help. However, chills at the time of the attack would point more particularly to gall-stone colic. In addition, it is important to consider the constancy of the pain, its dependence upon dietetic influences, its relief by the expulsion of flatus, etc.

As far as objective symptoms are concerned the most important are those which point to obstruction of the gut. These, of course, may be absent for a long time. Most important among them are borborygmi in the region of the tumor and succussion sounds along the ascending colon; it must not be forgotten, however, that even disease of the gall-bladder may secondarily lead to slight obstruction in the region of the hepatic flexure.

Diarrhœa when present would point towards an intestinal origin of the pains, for gall-duct colic, especially when due to stone, is almost always accompanied by constipation.

5. *Movable Kidney.*—Errors are very easily made, because it is not infrequent that, together with an irregular cholelithiasis, there exists a movable kidney which is assumed to be the cause of the entire trouble. This combination is quite usual, and therefore errors often occur. A mistake is most easily made when we are dealing with cases of cholelithiasis which run their course with constant pain

in the epigastrium, without the real colicky attacks and without icterus. The pain in these cases is influenced by jarring and motion, and it is not at all unlikely that when the kidney is movable and at the same time gall-stones are present, the tugging of the loose kidney may reflexly lead to peristaltic unrest in the bile-duct system.

If the colicky pains occur while the body is in complete rest, for instance, during sleep, of course the assumption of movable kidney is quite out of the question.

6. *Hysteria.*—This error can be made only when the existing cholelithiasis is of an atypical kind. Here also one must not forget that the conditions may frequently coincide. Whenever, of course, purely mechanical methods, such as the position of the patient, exert an influence upon the pain, we can hardly assume that the condition is entirely of a functional nature. So, too, it is important to know whether there is a lack of harmony between the general nervous condition and the severity of the local pain, for with an improvement in the general nervous condition, the local pains in the epigastrium are rather more likely to increase than to decrease when gall-stones are present. General rules cannot be made for cases of this kind, and it is of the greatest importance to consider carefully the individuality of the patient in order to make a correct diagnosis. When, together with the existence of gall-stones, severe hysteria is present, even opera-

tive interference will not always guarantee complete cessation of the pains. It seems that in these cases we must consider that we are dealing in part with a visceral neuralgia (solar plexus? *cf.* page 97), in which the gall-bladder pain has the same relation to the neuralgia that a carious tooth would have to the ordinary trigeminal neuralgia. The extraction of the tooth might bring about a temporary improvement, but the neuralgic foundation would remain.

It is an open question whether or not pure neuralgia of the liver may exist by itself without organic foundation. According to some observers such cases may occur with all the attributes of a true gall-stone colic, except fever and inflammatory changes.

7. *Syphilis of the Liver.*—Attacks of pain may occur in the train of rapidly developing liver gummata, the causes of the pain being sudden tension of the liver capsule and local peritonitis. The confusion of this condition with gall-stone colic seems to be all the more likely because these cases are followed by jaundice and increase of temperature, and palpation of the liver reveals enlargement and tenderness. However, more careful examination will frequently show unevenness of the liver surface, and, on the other hand, syphilitic processes occur frequently in the left lobe of the liver; thus there may be a peculiar left-sided localization of the pains, a localization which hardly ever occurs in gall-stone colic. In every difficult case the prompt improvement under iodides may be decisive. Similar

symptoms may occur with primary or secondary carcinoma of the liver.

In our introduction we have already called attention to the fact that while gall-bladder colic is usually caused by the existence of gall-stones, there may nevertheless exist cases of true gall-bladder colic without the presence of gall-stones. These cases, as it was pointed out, are chiefly dependent upon inflammatory stenoses along the bile ducts.

The occasional combination of a gall-stone colic with hæmatemesis and melæna would lead us to think of aneurysm of the hepatic artery. Likewise we would have to consider ulcerative-stenotic conditions at the papilla of Vater.

In patients who are suffering from marked enteroptosis mild attacks of such colicky pains would suggest kinking along the cystic duct. When other symptoms point to biliary cirrhosis the possibility of an inflammatory colic of the gall-ducts must be thought of.

It is a point of practical importance that in patients who have their first attack of gall-stone colic at an advanced age, or in those in whom such attacks are repeated only after prolonged intervals, we may be dealing not with gall-stones but with a developing carcinoma of the gall-bladder, or possibly with both conditions together. An early operation for carcinoma of the gall-bladder is made possible only on the basis of the subjective phenomena, and even then only upon a diagnosis of probability.

Gall-bladder Pains without Attacks of Colic.

In all the preceding conditions we have spoken of attacks of colicky pain which are probably caused by the more or less sudden increase of intravesical pressure or by tonic contractions along the musculature of the bile ducts.

There are still those cases to be considered in which the same etiological factors may give rise to more gradual pathological changes, and therefore express themselves in more constant local pains over the gall-bladder rather than in paroxysmal attacks. Here, too, we must consider stenotic processes which lead to an overdistention of the gall-bladder. The chief conditions which must be thought of in this connection are diseases of the pancreas of an inflammatory or malignant nature, and inflammatory processes of the gall-bladder itself, either of a local nature (gall-stones, typhoid) or of an ascending nature (duodenal catarrh, cholangeitis, biliary cirrhosis). Added to these conditions there frequently occur inflammatory changes in the peritoneal coverings of the organ, a pericholecystitis; and this gives us a third factor which, together with the distention and the muscular contractions, adds to the general picture of gall-bladder pains. Such lesions are for many reasons extremely unsatisfactory for physical examination, and the subjective pains, therefore, assume especial diagnostic importance.

Generally the pains are localized in the gall-bladder region itself; in cases of enteroptosis or corset liver the pains may be close to the ileocæcal region.

The peculiarities of the pains which can be produced by physical examination have already been spoken of in the section on gall-bladder colic. Sharply localized, stabbing pains in the gall-bladder region may be caused by percussion in the right loin, by coughing, by sneezing, and by the pressure exerted in strong contraction of the abdominal muscles such as vomiting, straining at stool, and rising from a horizontal position. Deep respiration causes pain over the gall-bladder, especially in those cases where pericholecystic complications exist. Spontaneous pain is very slight in many cases; and often the fact that there is tenderness of the gall-bladder is brought out only by the methods just described.

Similar sensations might occasionally be caused by an abnormally movable right kidney. Findings of such a nature, of course, cannot be decisive, since gall-bladder disease is frequently coëxistent with movable kidney. It would be much more important to find an enlarged gall-bladder. Increase of the temperature (cholecystitis) and persistence of the pain during the prone position would point towards the gall-bladder as the origin of the pains.

Pains due to flatulence, which so frequently occur with atony of the gut, as in chronic nicotine poisoning and neurasthenia, are occasionally localized over the gall-bladder region (hepatic flexure), but can easily be distinguished from gall-bladder disease by the fact that they vary in their localization. Firm pressure is often grateful to the patient.

II. and III. Distention and Inflammation of the Capsule of the Liver.

Up to the present time we have spoken only of liver pains which have their seat in the biliary system, and its appendix, the gall-bladder. Here we had in addition to the factor of distention the cramp-like peristalsis of the muscular elements. In the following paragraphs we will deal with conditions localized in the peritonéal coverings of the liver. In these, pains are caused both by distention, when the liver is enlarged, and by inflammatory processes about the liver (perihepatitis).

It is more practical and useful not to separate these two varieties of pain, since, although they are distinct etiologically, they very frequently occur together.

(a) *Hæmatogenous Congestion of the Liver.*—Such cases are usually caused by cardiac lesions, especially by insufficiency of the right heart. Nevertheless occasionally extracardial causes must be considered, such as narrowing of the inferior vena cava by aneurysms, thrombi, fibrous changes of the pericardium, fluid exudate in the right pleura, right pneumothorax, and narrowing of the hepatic veins through perihepatitis.

Next to the regularly present enlargement of the organ the most constant symptom of these anomalies of the circulation, at least in their acute and subacute stages, is the characteristic pain. There can hardly be any reason for doubting that the mechanism of the pains in these cases depends upon the

stretching of the liver capsule. The quality of these pains is almost always that of a feeling of pressure in the epigastrium which varies in degree from simple discomfort to actual pain, so that the patients speak often of "stomach-ache." Radiations do not occur in this kind of pain. The patient frequently feels as though there were a constant and heavy weight upon the stomach.

The most characteristic quality by which this species of pain can be recognized is the increase in its severity which occurs whenever more work is laid upon the heart. This, of course, is natural in that it increases the actual cause of the pain. The patient who is suffering from a congested liver complains of an increase of the pain when he walks upstairs, whereas it is very much less marked when he is walking downstairs. Struggling against the wind, running, in short, every physical exertion increase the suffering.

Percussion of the liver is painful, and it is not surprising that in the face of the diffuse and even stretching of the liver-capsule the pain, on percussion, should have an analogously diffuse and even distribution. As a matter of fact, however, the maximum pain is felt in percussion along the linea alba and extends in this line from the tip of the ensiform down to the liver margin. This close correspondence of the zone of greatest pain with the liver dullness in the line of the linea alba is particularly important in differentiating this condition from other epigastric pains. For this reason examina-

tion by percussion is more important in this condition than examination by palpation.

The explanation of the fact that in spite of the diffuse nature of the process the maximum pain, on percussion, extends along the linea alba probably lies in the circumstance that here the muscular defense is least effectual, especially in cases where there is some separation of the recti. Probably the same explanation holds good for a similar localization of the greatest tenderness along the linea alba in gastric ulcer.

Whenever, therefore, one wishes to examine for pain in cases suspicious of hepatic congestion, it is advisable to percuss along the linea alba.

If cases dependent upon uncompensated cardiac lesions are examined in this way while they are under treatment with digitalis, it is often possible to notice that the pain will diminish from day to day if approximately the same force of percussion is used. In this way we have a very simple means of controlling the processes of compensation of the right heart. At the same time the influence exerted by the therapy upon the tenderness throws definite light upon the etiology of the condition.

The position of the body has a definite influence upon the intensity of the suffering. The upright position naturally leads to a greater stagnation of blood in the liver, while the horizontal position allows of a better outflow of blood.

Dietetic conditions also may have a definite effect upon the hyperæmia of the liver and therefore upon the pains (spices, large quantities of meat, etc.).

Occasionally mechanical and dietetic conditions may be combined (bodily exertion immediately after meals).

The physical signs accompanying increase of the pain are chiefly enlargement and firmer consistency of the organ. The latter condition is frequently noticed by the patient himself, who may observe a diffuse firmness in the epigastrium after exertion.

In many cases, of course, the congestion of the liver is merely a secondary factor in the general clinical picture, and it may be easy to explain the enlargement of the organ without paying much attention to the character and quality of the pains. The enlargement of the liver falls in naturally with the cyanosis and the œdema. On the other hand, there are cases in which the hepatic congestion and the suffering resulting from it may be predominant.

The cases chiefly to be considered in this connection are especially those of acute pericarditis, which are frequently characterized by epigastric rather than by cardiac symptoms; and these epigastric symptoms, on closer analysis, can be recognized as being due to hepatic congestion. The same is true of the symptoms accompanying many cases of adherent pericardium, and in these often the diagnosis of hepatic congestion can be made before the condition of the heart is recognized.

Again there are cases in which, even when the signs of an insufficiency of the right ventricle are perfectly clear, there may be much doubt as to whether the existing enlargement of the liver is to

be explained by simple congestion, or whether other pathological processes, for instance cirrhosis, may have a part in it. In just these cases the examination of the organ for its sensitiveness and the zones of distribution of these pains, as determined by physical examination, may lend invaluable aid.

The pathological basis of the pain of congestion lies in the acute or subacute distention of the organ and its peritoneal coverings. This, however, presupposes the possibility of distending the organ itself. In cases where there has been much formation of fibrous tissue, as in cirrhosis, distention is not possible, and even an acute cardiac insufficiency is unable to produce any marked degree of pain. Therefore, whenever acute general congestion exists without any marked degree of pain in the liver, we must always be suspicious of a preëxisting cirrhosis. It is well, however, to be cautious in those cases where the cardiac lesion has developed in very chronic stages and has carried in its train a considerable degree of connective tissue formation (cardiac cirrhosis).

Occasionally inflammatory factors, such as acute perihepatitis, may contribute to the production of the pain. Such complications are characterized by a sudden increase in the subjective pain without a corresponding exacerbation of the cardiac condition. In contradistinction to the dull, aching pressure produced by stretching of the capsule, this pain is acute and stabbing, and because of its peritoneal and inflammatory nature it is increased upon deep

respiration (rubbing of peritoneal surfaces). This pain is independent of digitalis treatment, but on the other hand is rapidly and effectually controlled by local treatment. When perihepatitis is present it is almost impossible to lie upon the painful side. Friction sounds accompany the pains only when there is a fibrinous exudation of considerable quantity and the fibrinous masses are of favorable consistency.

Further details of the pains accompanying perihepatitis will be discussed when speaking of syphilis of the liver.

(b) *Biliary Congestion.*—In the same way that an overfilling of the blood vessels may lead, by a secondary stretching of the capsule, to liver pains, so the condition of congestion in the bile ducts may give rise to a very similar state of affairs. The suffering produced by biliary congestion, however, rarely equals in intensity that produced by congestion in the blood vessels, largely because of the differences of pressure in the two conditions. Nevertheless pain over the liver upon percussion along the linea alba is not uncommon in those diseases which are accompanied by congestion of bile (catarrhal jaundice, Hanot's cirrhosis, carcinoma of the head of the pancreas, etc.).

These conditions are also accompanied by the gall-bladder pains which we have mentioned above, which occur without true colicky attacks. These may exist in varying degrees, from the simple sensation of pressure to conditions approaching gall-

bladder colic. It is therefore always important to percuss along the linea alba as well as over the gall-bladder itself.

Since stagnation of the bile is often directly the result of inflammation of the mucous membrane of the passages, and since, on the other hand, biliary congestion favors inflammation of these passages, it is not surprising that these conditions are frequently accompanied by perihepatitis and the pains characteristic of this condition. Therefore the patient who is suffering from Hanot's cirrhosis often complains of a sharp pain along the right costal margin or in the region of the right hypochondrium. This pain is often dependent upon movements which cause peritoneal friction, such as running, coughing, sneezing, or deep respiration. Sometimes, though rarely, it radiates towards the right shoulder. Such variation is entirely consistent with its subdiaphragmatic position. The pains which occur in the back and are increased by stooping must be explained by the distention of the liver capsule.

We have already mentioned that gall-bladder colic may, though rarely, be part of the clinical picture of a Hanot's cirrhosis.

Tenderness on percussion over the liver, along the linea alba and over the gall-bladder as well, is occasionally found in cases of catarrhal jaundice, and is directly proportionate to the degree of biliary congestion.

In cases where the inflammatory processes are not limited to the larger passages alone but extend

into the bile capillaries, extension takes place into the peritoneal coverings, and thus a new reason for tenderness is added. Therefore, whenever the pain is extremely acute without great enlargement of the organ, it is logical to think of an inflammatory perihepatitis. In such cases also the gall-bladder becomes involved and there is local tenderness to palpation and percussion, and local pain in the gall-bladder region upon jarring of the body. When this occurs it is important to think of the possibility of preëxisting lesions in the gall-bladder, such as gall-stones, since ordinarily the gall-bladder pains are not an accompaniment of catarrhal icterus.

In considering conditions which lead to abnormal stretching of the liver capsule, special attention is due to the cystic new growths of the liver, and particularly to the development of echinococcus cysts. The pains which occur in this condition remind us in many of their peculiarities of the phenomena considered under the heading of gall-bladder colic.

In rare instances the passage of small cysts through the bile ducts may give rise to attacks of pain. More frequently, however, pains in this condition are due to pressure and consequent stenosis of the gall-ducts. Likewise, sudden changes in volume of the echinococcus cysts frequently occur, and these give rise to inflammatory swelling of the liver tissue surrounding the growth. The attacks of pain, which often occur suddenly, are usually localized in the right hypochondrium under the right costal border, and radiate towards the right shoulder blade

and the sternum. The pain may also begin in the back and radiate forward on both sides; more or less constant pain in both scapulæ and in the back may be present.

The similarity to gall-stone colic may be accentuated by the occurrence of nocturnal attacks. The attacks may be colicky, often severe enough to cause syncope; again they may be of a more constant dull character. Mechanical factors materially influence the pains. Thus the pain is often at its maximum when the patient lies on the left side, and in this position has a sensation of a heavy mass being dragged from right to left. Jarring of the body increases the pain. Thus sneezing, coughing, percussion upon the right loin, or any exertion causes pain. Motions which are dependent upon contraction of the abdominal musculature, bending, lifting, etc., lead to stabbing sensations over the liver. The echinococcus cyst itself is sensitive in but few of the cases. Accompanying the attacks of pain, syncope may occur; sensations of suffocation and rise of temperature are not rare. Singultus may occur and give a clue to the subdiaphragmatic nature of the condition. Great attention must be paid to those symptoms which emanate from the stomach and often lead to an erroneous diagnosis of gastric disease. These are due in most cases to the crowding of the stomach by the cystic sac, which produces the symptoms of slight obstruction and gastric peristalsis. This error can be well guarded against if, on principle, in all cases of apparent gastric dis-

ease, we examine the liver and the spleen as well as the stomach.

The statements made in regard to the pain accompanying distention of the liver capsule are hard to reconcile with those cases of carcinomatous infiltration of the liver which are unaccompanied by pain, even when the liver is enormously enlarged. The same is true of most cases of fatty or hyalin infiltration of the liver. The strange behavior of these diseases is probably explained by the more gradual enlargement which the liver undergoes. In carcinoma, especially, the liver is not enlarged in toto but in different places at different times, so that the peritoneal coverings have an opportunity to adjust themselves to the changed conditions. If carcinoma of the liver is accompanied by pains at all, they are usually traceable directly to stenosis along the bile-ducts (carcinoma of the pancreas or the bile-ducts) or to the perihepatitis. Occasionally, too, carcinoma of the liver may be complicated by gall-stones, which then would account for the pain. The sharp pains which indicate perihepatitis seem to be associated chiefly with secondary carcinoma of the liver, especially when the primary growth is an ulcerating neoplasm of the gastro-intestinal tract. It stands to reason that in such cases the conditions are favorable for secondary inflammatory processes. In cases of this kind occasionally sharp and prolonged attacks of pain occur, and these are dependent upon all those motions which give rise to peritoneal friction, thus pointing to the peritoneal cause of the

suffering. Pain is caused especially by those carcinomatous nodules which lie subperitoneally and secondarily involve the peritoneum.

There are many cases in which it is important to determine whether, with the existence of a gastric carcinoma, the liver has already been involved or not. In these we are forced to pay particular attention to the existence of pain in the right hypochondrium, since it is hardly ever possible to discover by physical examination carcinomatous nodules situated under the dome of the diaphragm; the same applies to circumscribed tenderness over the palpable liver surface. Acute and paroxysmal attacks of pain of a moderate colicky nature are characteristic chiefly of neoplasms which have caused stenosis of the bile passages. Chief among these are the neoplasms situated in the pancreas.

Carcinoma of the gall-ducts occasionally runs its course without either subjective or objective pain. Local pain involving the gall-bladder and in part the right lobe of the liver accompanies all those cases, however, in which inflammatory changes have taken place within or about the gall-bladder. In these cases, too, mild attacks of gall-bladder colic may occur even without the existence of a gall-stone.

The fact that the left-sided position is particularly painful in many cases of carcinomatous enlargement of the liver is explained upon purely mechanical grounds. In this position the heavy organ drops towards the left side and the patient feels a drawing pain which extends from right to left. If

the capsule of the liver is inflamed this change of position of the liver gives rise to extreme pain, and, in such cases, the patient voluntarily prefers to lie flat upon his back; thus immobilizing the organ. Very frequently stooping gives rise to great pain in the back.

Attacks of pain of intestinal origin are not rare in carcinoma of the liver. These are due, on the one hand, to direct infiltration of the colon from the gall-bladder and consequent moderate obstruction. On the other hand, there frequently exists a tendency to meteorism which leads, by a local collection of flatus, to attacks of a colicky nature. These attacks are easily controlled by emptying the bowels.

Much more marked than in carcinoma of the liver are the pains which accompany liver gummata, and these are so regular that in all cases where pains occur in the liver region it is necessary to think of this possibility.

A local perihepatitis is almost regularly present because of the inflammatory nature of the new growth, and in this secondary phenomenon lies the causes of the pain. This is made particularly evident by the factors which influence the pain. Pain is initiated or increased by deep respiration, by rapid walking, by jarring of the body, by walking downstairs, by slipping of the right foot, and by laughing or coughing.

Just as direct pressure upon the painful area increases the pain, so motions which indirectly give rise to greater pressure increase it as well. Occa-

sionally, too, the taking of food will cause increased suffering (perihepatic adhesions).

A great deal of differential knowledge may be gained by the therapy. The pains are almost immediately relieved by iodides and (in one of the author's cases) by arsenic. If the pains are situated on the right side under the costal margin, there is radiation into the right shoulder blade and into the back. If the pain, in addition to this radiation, assumes the nature of a colicky attack and is accompanied by vomiting, slight fever, and icterus, the danger of confusing it with gall-bladder colic is plain. Here only an exact physical examination can make the differentiation, by revealing a circumscribed tumor upon the liver surface. Very frequently, however, the pains are situated along the left costal margin, because of the frequent involvement of the left lobe of the liver. They are then more constant in their nature, without colicky attacks. They may be sharp or dull without giving rise to radiation, and tenderness over the gall-bladder region may be entirely absent.

In contradistinction to echinococcus, in the syphilitic condition the tumor itself is markedly sensitive.

PANCREAS.

In this organ, in which we have neither the mechanism of muscular contraction nor the intimate relation to the peritoneum found in the liver, there would seem to be very little basis for the development of characteristic pains. On the other hand,

experience tells us that certain lesions of the pancreas are accompanied regularly by attacks of peculiarly intense pain. The most important among such lesions are pancreatic cysts.

In accounting for this it is of primary importance to consider the intimate relations which the pancreas holds to the nervous system in general and to the solar plexus in particular; and it is quite likely that, occasionally, we are confronted with purely neuralgic conditions. This, however, does not exclude the possibility that occasionally pains may be produced in the pancreas by exactly the same mechanism by which they are produced in the liver; that is, by cramp-like contractions and increased pressure in the excretory ducts. Because of the disproportionate structure of the muscular apparatus of these ducts, however, it is hardly possible to explain in this way any of the very intense paroxysmal attacks.

Again, it is quite easy to understand that many of the pains occurring with pancreatic lesions may emanate from neighboring organs, rather than from the pancreas itself.

In this connection the very intimate topographical relation of the terminal end of the ductus choledochus to the head of the pancreas is important; the close apposition of these two structures makes it self-evident that any pathological changes in the head of the pancreas would lead to compression of the common bile duct; and this, of course, would lead to stenosis with consequent colicky attacks in the gall-ducts.

We must remember, however, that frequently diseases of the gall-passages and of the pancreas may be present at the same time. In cysts of the pancreas, the pancreatic nature of the disease may be particularly obscured by pressure upon portions of the gut, giving rise to paresis, peritonitis, and their consequent train of symptoms. Because of the very intimate relationship of vascular disease to the general pathology of the pancreas, we must occasionally think of pains arising in the vessels.

From these considerations it naturally becomes clear that any attempt to separate purely local pancreatic pains from those depending upon the neighboring organs must be extremely difficult.

The law which states, in a general way, that organ pains correspond in localization to the organ from which they emanate, is borne out by pancreatic conditions. So, because of the chiefly left-sided position of the pancreas, the pains which arise in it are situated in the left half of the epigastrium, to the left of the umbilicus, or even in the left loin. Occasionally with these, radiations may be observed which are symmetrical with those occurring in gall-bladder colic.

It has been mentioned above that occasionally the colic accompanying pyloric stenosis may behave in the same way (*v.* page 175). This left-sided character of the pain in pancreatic lesions might under certain conditions be of gastric origin, in that the pathological changes in the pancreas have secondarily produced a pyloric stenosis by compression

and spasm. At all events it is necessary to pay very close attention to the presence of gastric distention, peristalsis, or sarcinæ in the vomitus or feces.

It is easy to understand that, corresponding with the retroperitoneal position of the organ, pains in the back should frequently occur. These pains sometimes radiate forward and around the waist. Sensitiveness to pain will change in its localization according to the position of the lesion in the pancreas. Since it is necessary, in palpating, to exert deep pressure towards the vertebral column, the localization of the tenderness is of little diagnostic value. It is important also to look for sensitiveness to pressure and percussion along the upper lumbar vertebræ, a symptom which I have had occasion to notice in several cases of diabetes. This is probably to be regarded as a reflex manifestation corresponding to the phenomena occurring with gastric ulcer and gall-bladder inflammations.

Whenever the sensitiveness is in the epigastrium, it is necessary, owing to the close relation of vascular disease to disease of the pancreas, to think of the possibility of purely vascular pain (hemorrhages or atheroma of the aorta). When sensitiveness occurs along the right costal border, even when sure of the presence of pancreatic disease, we must not neglect to search carefully for tumefaction of the gall-bladder. This may easily follow constriction of the common bile-duct in the head of the pancreas.

A regular relation of the pains in diseases of the pancreas to the taking of food could logically be

assumed since the food, passing out of the stomach two or three hours after a meal, may readily cause pain by reflexly inciting pancreatic secretion, and therefore producing hyperæmia of the organ; but, of course, whenever such a direct relation between the meal and the attack of pain occurs it would be more reasonable to think of secondary pyloric stenosis or gastralgia.

It has frequently been noticed that the pain in the back emanating from the pancreas occurs with especial frequency at night; and this is explained by the fact that the dorsal position is most apt to cause discomfort.

The quality of the pain is of great diagnostic importance, in that it frequently occurs with great suddenness and severity and is accompanied by signs of collapse.

The factors influencing the pain are naturally dependent upon the mechanism underlying each individual attack. In cases in which we are dealing with true neuralgia without the presence of other factors, it is quite impossible to influence the pains in any way except by occasionally effectual narcotics.

In cases where the pain is due to pressure of tumors (cyst or neoplasms), or is caused by peritoneal adhesions to the surrounding organs (as in pancreatic abscesses), the conditions are quite different. In such cases purely mechanical causes, jarring and tugging upon compressed nerves in rapid change of position, stooping, coughing, or deep breathing, may exert a very marked influence upon

the pains. Thus in the case of cysts and neoplasms the dorsal position is very painful, and turning upon the side brings almost immediate relief. Whenever we are sure of the presence of a pancreatic lesion and we can obtain immediate relief from the pains by the belching following the administration of alkaloids, we may conclude that there is present a secondary stenosis of the duodenum with consequent distention of the stomach.

When the pains have a purely vascular origin we may expect them occasionally to be initiated by the hyperæmia accompanying digestion.

Since, in a general way, the diagnostic aid given us by the pain in these cases is extremely small, it is very important to consider closely all other possible clues. We must remember that a large proportion of the cases of pancreatic disease occurs in very stout alcoholic individuals; and that these are especially prone to arteriosclerosis and therefore to hæmorrhage and necrosis.

It is well also to think of the possibility of a pancreatic lesion in all cases of apparent peritonitis, or intestinal obstruction. The same holds true of all cases of colicky abdominal pains which follow a trauma, blows in the epigastrium, etc. If in these cases no indican is found in the urine, but glycosuria appears spasmodically or constantly after the attack of pain, the suspicion of a pancreatic lesion becomes strong. This opinion is much strengthened if, in addition to these signs, the stools show an insufficient digestion of albumins and fats, and physical

examination justifies the consideration of pancreatic disease.

In spite of all these things it will often be impossible to distinguish diseases of the pancreas from peritonitis, acute intestinal stenosis, cholelithiasis, gastralgia, etc.

Some of the lesions of the pancreas are accompanied by pains of definite quality which, while not entirely characteristic, may still give much diagnostic aid.

(a) *Carcinoma of the Head of the Pancreas.*—Pain in the back with occasionally definite relation to the position of the body may occur. This is by no means a rule. The first pains seem frequently to occur in the neighborhood of the gall-bladder because of the overdistention or stenosis of the common bile-duct. The pains seem to be dependent chiefly upon mechanical conditions, such as the position of the body, and are similar in this respect to those occurring in the gall-bladder. Again the first pains may be dependent entirely upon the local perihepatitis which accompanies the subperitoneal metastases.

In this way, in some cases, the entire attention of the physician may be concentrated upon the liver and gall-passages, and the pancreatic lesion may escape detection. In the same way the attention may be directed chiefly toward the pylorus or duodenum when subjective or objective symptoms of stenosis occur in these places. When this occurs, however, the pains are much less severe than in the

primary ulcerative or stenotic processes of these organs.

(b) *Pancreatic Cyst.*—In this condition very sudden attacks of pain occur, sometimes under the left, sometimes under the right costal border, accompanied by syncope, collapse, vomiting and diarrhœa. These attacks may in part be due to sudden increase of tension whenever the cyst contents rapidly increase in volume. Again, they may be neuralgic in their nature, or may consist in the colic following secondary stenosis of the gut.

(c) *Suppurative Pancreatitis.*—Not rarely the acute attack of pain which occurs in these cases is followed by icterus. This would naturally lead to the danger of confusing the condition with cholelithiasis. The error can be guarded against only by very careful palpation and localization of the sensitive point.

(d) *Hemorrhages.*—When we are dealing with drunkards, very fat people, or individuals with marked arterial changes, all sudden attacks of epigastric pain accompanied by collapse and dangerous symptoms must be considered as possibly due to a hæmorrhage into the pancreas. It is almost never possible to make this diagnosis with certainty.

(e) *Pancreatic Calculi.*—Attacks of pain which are due to stones in the pancreatic duct usually begin in the left half of the epigastrium and radiate over the left shoulder. This left-sided localization occasionally permits their differentiation from the very similar attacks of gall-stone colic, a differen-

tiation which is rendered very difficult by the fact that occasionally pancreatic concretions are accompanied by icterus. The absence, too, of sensitiveness to pressure over the gall-bladder would be of great aid. Differentiation from ulcerations similarly localized, for instance those occurring in the pylorus, can be made by considering the independence of the pancreatic pains from the quality and quantity of the food. The greatest weight in making these difficult diagnoses must, of course, be laid upon the secondary symptoms.

Diarrhœa must be very carefully inquired for, since it is rather a rare symptom in the other varieties of colic. In addition to this careful examination must be made for the detection of glycosuria and of excess of fat in the stools. The stools, too, should be searched for bile-free concretions consisting of carbonates and phosphates of calcium.

CHAPTER VIII.

Urinary System and Spleen.

KIDNEY.

In discussing the factors which produce pain in the urogenital system, we may avoid much repetition by calling attention to the close analogy existing between this system and that of the liver and gall-ducts. The pelvis of the kidney, the ureter and the bladder find close analogies in the gall-bladder, the gall-passages and the duodenum, and in a general way the conditions producing colicky pains along these hollow muscular organs are the same. It may be assumed that conditions which produce an increase of pressure upon the capsule of the liver, such as congestion of blood or bile, or tumor formation, may find close analogies in the kidney itself. The same holds good of perihepatitis and perinephritis. For this reason we can follow approximately the same classification.

I. True Kidney Pains.

Here the pain is caused by acute or chronic tension upon the kidney capsule or inflammatory changes in the surrounding tissue. In some cases also there may be direct injury by destructive processes of the renal plexus. At any rate it is never correct to speak of renal colic; for in the kidney itself the conditions for the production of such

colicky pains are absent, such pains occurring only in hollow organs.

While it is impossible to differentiate by their pains alone the various conditions which produce such stretching of the capsule of the kidney, it is for practical reasons better to consider the conditions separately.

(a) *Embolism of the Renal Arteries.*—It is extremely rare for this lesion to be accompanied by pain. In the year 1901 I was able to find in the literature only seven reported cases, and therefore it may seem wrong to begin our considerations with this condition. But in kidney infarcts the pain occurs in such a characteristically sudden way that it furnishes a most clear-cut subject for study.

The pain in this condition is distinguished from all other true kidney pains only by the great suddenness of its onset (apoplectiform). In other respects every one of the details which are observed in kidney pains occurs, and for this very reason a close description of the condition will serve most excellently to illustrate the others.

Subjective pains, as well as the objective ones produced by pressure, palpation and percussion, correspond in a general way to the position of the organ in front and behind. The kidney extends vertically from the middle of the eleventh thoracic vertebra to the lower limit of the body of the second lumbar vertebra. In an upward direction, therefore, it extends to above the twelfth thoracic vertebra. Its posterior surface for a short distance is apposed

to that part of the diaphragm at which the lumbar and costal portions of this organ join. The greater part of it lies against the quadratus lumborum. Since the kidney varies much in its localization we must occasionally be prepared to find abnormal localization of the pain. Thus a low position of the kidney may give rise to pains in the ileocæcal region. It must be remembered also that in some cases the kidney may have projections towards the median line (horse-shoe kidney), or occasionally in the pelvis, or the sacrum, along the position of the sacro-iliac junction. These abnormal positions would naturally bring with them abnormal positions of the pain.

The kidney pain is especially easy to recognize when we are dealing with the right kidney and the pains are projected forwards. This occasionally happens in renal infarcts. If we consider the secondary symptoms, such as vomiting, pain in the liver due to congestion, tenderness along the gall-bladder and appendix, and fever, the danger of confusion with gall-bladder or appendicular pain is extremely probable.

It seems to the author especially important to note that the pain in disease of the kidney is located particularly in the flank; while along the mammary line in front, or in the lumbar region behind, the tenderness to pressure or percussion is much less marked.

Another source of frequent error lies in the fact that pressure of the abdomen often gives rise to a

very diffuse pain (especially when the infarction is bilateral). This is explained by the fact that the pressure reaches the diseased organ indirectly through the interposed organs. For the more exact localization of the pain in these cases percussion is more useful than palpation.

The patient in cases of true kidney pain almost always localizes the pain deeply, away from the abdominal wall, a fact which often helps greatly in differentiating it from neuralgia or myalgia.

Very occasionally there is sensitiveness in the lower intercostal spaces as far up as the scapular angle posteriorly, and about four centimeters above the costal border anteriorly. This must be regarded as merely a reflex pain, since it occasionally occurs in pyelonephritis without the existence of a secondary pleural inflammation.

Sensitiveness to pressure is found chiefly in: (1) the flank, in the axillary line; (2) the angle between the lateral border of the erector spinæ and the twelfth rib; (3) anteriorly in the region below the gall-bladder corresponding to the position of the kidney.

A characteristic radiation does not accompany these true kidney pains and therefore is not present with renal infarcts. This is due to the absence of a path of transmission (ureter); yet in rare cases there may be sensations in the thigh. When these do occur, they can be regarded as due to pressure upon the twelfth dorsal nerve and branches of the lumbar plexus, by thickening of the capsule.

The factors influencing the pains of renal infarct are chiefly mechanical. Normally the kidney is supposed to be entirely immovable. This is quite theoretical, however, and practically we may find all degrees of mobility. It is not surprising, therefore, that in cases of inflammatory changes within the kidney or about the capsule (partial necrosis of the renal tissue, tuberculosis, etc.), forcible manipulation of the organ is accompanied by more or less pain; thus, too, a definite position of greatest pain is developed quite acutely in cases where enteroptosis and weakness of the abdominal walls are present. The patients are unable to lie on either side without suffering, and it is peculiar that pain is most severe when lying upon the healthy side. In this position they have the sensation of a painful tugging extending from the diseased side towards the healthy. The actual descent of the kidney downwards toward the side upon which he lies is felt acutely and distinctly by the patient.

In the same way definite painful positions are present in tuberculosis, in renal tumors and in pyelonephrosis; only occasionally does the position of greatest pain correspond with the diseased side. If change of position and slight tugging by reason of the weight of the organ itself are able to cause pain, it is all the more reasonable to believe that forcible jarring would cause localized pain in the neighborhood of the kidney; and this actually occurs with coughing, vomiting, riding in a carriage, jumping, or making a false step. All motions which call for

contraction of the ileopsoas muscle, such as rising, and stretching of the flexed thigh, will of course give pain because of the close apposition of the kidney to the muscle.

It is hardly necessary to mention that pressure in the kidney region, or percussion with the clenched fist would cause pain. Strong percussion is especially helpful in localizing the exact extent of the pain and in demonstrating its diminution during convalescence. It is worth mentioning, too, that in cases of renal infarct the objective pain is present for some time after the subjective has disappeared.

The pain accompanying renal infarct resembles, in the suddenness of its onset, colic of the ureter, but is sharply differentiated from the latter condition by the fact that the pain itself, after the onset, is not colicky but stabbing, aching and constant.

In attributing any pain to renal infarction, we must consider the condition of the heart (existence of a mitral stenosis). We must note particularly the sudden onset of the pain and the subsequent absence of any paroxysmal quality. Most abdominal pains are of a colicky nature, and the absence of the paroxysmal element is of great differential importance.

It is, furthermore, very important to determine whether or not there is difficulty of micturition. Urination becomes difficult (renal dysuria) and can be accomplished only in the standing position and with great exertion; occasionally there are symptoms of moderate incontinence. The quantity may

be at first diminished or there may even be complete anuria. The frequent desire to urinate seems to be absent in these cases, a feature which is of great differential value since pains arising in the excretory passages are usually accompanied by this symptom.

The characteristic features of the urine analysis, I have found to be the following:

There is often a sudden and copious albuminuria, as high as 2 per cent., which very rapidly diminishes. There is occasionally a very slight hæmaturia, often discovered only by microscopical examination. Occasionally, also, epithelial casts may be found in the sediment.

The consideration of these secondary symptoms which point to the urogenital system will guard us against confusion with the colics of the gall-bladder and appendix, an error which is the more easily made when the embolus is situated on the right side.

The vomiting and hiccoughing which occur with the onset, can lead easily to the false diagnosis of acute peritonitis. This is especially so when the infarct is bilateral and in consequence the abdominal tenderness is very diffuse.

The pain accompanying renal infarct is sharply differentiated from the pains which occur along the ureter (nephrolithiasis) by the complete absence of paroxysms, the continuous character of the pains, and the slight tendency to radiation. In ureteral colic the pain is of a remarkably intermittent type and radiations are very frequent. In renal infarction the kidney is especially sensitive to pressure,

whereas in the other condition tenderness may occur only along the course of the ureter.

It is quite impossible to differentiate the pain of renal infarct from that accompanying other intra-renal conditions. All other diseases which occur in this location may give rise to similar pains, and for that reason the description just given may serve as a type for all true "nephralgia." I will therefore spend little time in discussing the other pathological conditions which occur in the kidney and are accompanied by pain.

(b) *Acute and Chronic Nephritis, Pyelitis, and Paranephritis.*—Acute paroxysmal pains may occasionally, though rarely, accompany the non-suppurative inflammations of the kidney. These are then due to pericapsular inflammation, and damming back of the urine, with acute congestion and increase in the capsular tension. Thus acute hyperæmia, as it occurs in cases of nephritis, may give rise to intense pains which are similar to those just described in renal infarct, and these pains may be one-sided in spite of symmetry in the pathological process. It is therefore advisable to be very cautious in the diagnosis of calculus when sudden colicky pain occurs in the neighborhood of the kidney in acute nephritis, even when, as in one of my own cases, radiation occurs into the thigh. Such an occurrence, while it must be thought of, is nevertheless extremely rare in all cases of non-suppurative nephritis. I have seen only one such case.

Of much greater frequency are those uncertain dull back-aches, the relation of which to the kidney is subject to great doubt and must be judged individually in each case. It is very rare that we have any definite factor which points to the kidney as the source of the pain. I have seen cases, however, in which the patient has stated that excessive drinking has increased the pain, while, on the other hand, discharge of the urine has decreased it considerably. The simultaneous occurrence of backache and renal œdema is also noteworthy. In persons with the uric acid diathesis pain in the kidney region is often associated with scanty urine and an abundant sediment of uric acid.

In contrast to lumbago, the pain in nephritis and pyelonephritis is not at all influenced by stooping; while, on the other hand, walking about, severe exertion, and pressure increase the pains, just as in the case of lumbago. In these conditions, too, the pain is occasionally one-sided. As a matter of practical importance it is well to examine the urine for albumin in all cases where a pain suggestive of lumbago exists, and this, especially, when no other clearly rheumatic pains are present.

It is also important, whenever albuminuria has been discovered, to examine the kidney for tenderness. Occasionally, hyperæmia of the kidney and consequently increased intracapsular pressure will give rise to sensitiveness on palpation. Percussion in the loin is best made with the clenched fist. By

palpation in front it is often possible to press directly upon the lower pole of the kidney. Whenever slight pressure in the loin or slight jarring in this neighborhood causes pain and we can determine the presence of hyperæsthesia along the ileohypogastric and genitocrural nerves, we must think of the possibility of paranephritic suppuration. In such cases the patient often lies with the thigh flexed and adducted, has chills, and suffers great pain upon change of position.

(c) *Renal Congestion.*—Just as the liver is the seat of pain when it is congested in consequence of cardiac insufficiency, so the kidney may be the seat of pain under similar conditions. This, however, occurs much more rarely. The pains in the back are then very promptly relieved by digitalis.

(d) *New Growths of the Kidney.*—Pain in the lumbar region and the flank, when unilateral, must occasionally arouse suspicion of an early neoplasm of the kidney and should lead to a careful palpation of the organ.

Increase in the intracapsular tension in consequence of the enlargement of the new growth, congestion or hæmorrhage into the tumor, may give rise to pain, even in the early stages. In these cases, too, the pains have the characteristics of true kidney pains in the special sense of the word, and correspond to the pains described for renal infarct. In consequence of the increased weight of the organ the tugging pains accompanying change of position will be

more noticeable than in infarction, so that the patient cannot bear to lie on the side opposite to that of the diseased kidney. The pain is often provoked by bending, lifting, or the carrying of a heavy weight. This may be due either to temporary passive hyperæmia or to direct pressure by the contracting abdominal muscles. In these cases, too, there may occasionally be sensitiveness to pressure in the corresponding thigh.

When the new growth penetrates into the pelvis of the kidney and secondary hemorrhage occurs, a new source of pain arises. This is a form of ureteral colic and may lead to difficulty in distinguishing the condition from nephrolithiasis.

In August, 1902, I was consulted by a Hungarian gentleman aged forty-four years. His first attack of pain had been in March, 1902, and had involved the lower abdomen, with radiation into the right testicle which was very tender. There was vomiting and backache, especially on the right side. Since then he had had three similar seizures of great intensity, coming on in the evening after a day of unusual exertion. During the attacks there was no disturbance of urination, but the urine was bloody in appearance and contained shreds of tissue. During the past two years he had often suffered from pain along the outer side of the right thigh, especially when seated. In September, 1902, the backache became continuous. The pain was least severe when he was lying quietly in the dorsal position, but was made much worse when he turned on the left side and then there was an unbearable sensation as if something heavy were being drawn over to the middle of the abdomen. On October 8 there was very violent backache with pain in the right thigh. On October 25 an attempt at defecation caused severe pain in the back on both sides. The patient died two days later, and at the autopsy a hypernephroma was found on the right side.

(e) *Tuberculosis of the Kidney.*—In many cases

tuberculosis of the kidney occurs without local pain. Nevertheless cases occur in which pain is one of the earliest symptoms. Whenever considerable capsular or pericapsular inflammation occurs, nephralgia will be present, and such pains, in the presence of a tuberculous tendency or of tuberculosis in other parts of the body, must always arouse suspicion. The pain seems to be in many cases extremely acute, and is described as boring like that of a boil.

Just as in new growth, so in tuberculosis of the kidney sudden paroxysmal attacks may occur. These occur whenever by ulceration and erosion of a blood vessel a hæmorrhage takes place into the pelvis from one of the papillæ.

The localization of the subjective and objective pains in this condition corresponds more or less closely to that described for renal infarct. The painful sensations which occasionally occur in the bladder and urethra, without any disease in these organs, must be explained by radiation, and consist chiefly in a painful desire to urinate, and burning pain before and after micturition; so that these pains may simulate a cystitis.

(f) *Paroxysmal Hæmoglobinuria.*—In this condition there is occasionally an acute hyperæmia of the kidney with consequent intracapsular pressure; the pain in the back which occurs is probably to be interpreted upon this basis.

The subjective pain which occurs in one or both kidneys is often accompanied by sensitiveness.

The pain is then dependent upon motion, such as rising from a stooping position, bending forward and turning towards the painful side.

(g) *Movable Kidney.*—It must be remembered, in considering movable kidney, that many patients in whom an enormous amount of freedom of motion of the kidney exists are almost entirely free from pain. This fact ought to be considered very seriously, because it is a quite common error that when a movable kidney is present in a patient, this is taken as the cause for any existing pain. In most cases it is not the wandering kidney which causes the pains. The individuals in whom they are present are usually of an extreme neurasthenic type, and suffer from a general enteroptosis. These are the conditions which should be treated rather than that of the movable organ itself. It stands to reason that in this condition there is a constant tugging on the renal plexus and indirectly therefore upon the solar plexus. This leads naturally to hyperæsthenia in the abdominal sympathetic system and consequent irritability of the stomach, gall-bladder and genitals. In this sense, a movable kidney and enteroptosis may be very disagreeable complications of gastric ulcer or cholelithiasis. Whenever an abnormally movable kidney is also tender and sensitive to pressure, it is well to think of diseases of this kidney, such as calculi, pyelitis, or tuberculosis.

In referring any existing pain to the mobility of the kidney, it is important to determine whether

motions which directly result in tugging or jarring of the organ, such as walking downstairs, rapid change of position, etc., are the ones which cause the pain; and it is never just to attribute pains which are present during absolute quiet to this cause. It must be remembered, however, that other diseases which are often accompanied by enteroptosis, such as ulcer, chronic appendicitis, and gall-bladder disease, may also be dependent upon such jarring movements.

The exact diagnosis in these cases is often extremely difficult, and it is better, therefore, to let the therapeutic interference precede the diagnosis rather than vice versa. Whenever the pain is relieved when the kidney is immobolized by a binder, the diagnosis, of course, is cleared up.

It is surely very rare that torsion of the pedicle of a movable kidney occurs; and it is well to think of this only after the exclusion of other causes for the attack. Whenever this does occur the pain that accompanies it can be explained in two ways: 1. Acute venous stasis. 2. Acute development of ureteral obstruction with secondary hydronephrosis. In both cases local sensitiveness would be easily explained. In the second case, however, an attack of polyuria would theoretically be expected towards the end of the attack. On the other hand, it is well to remember that in neurasthenic individuals, among whom the large majority of movable kidneys occur, polyuria is not a rare symptom.

II. Pains Caused by Distention and Muscular Spasm along the Urogenital Tract (Renal Pelvis and Ureter).

The pains which are considered in this connection are in their genesis closely related to those occurring in the gall-bladder system, and may easily be classified in the same way. The pelvis of the kidney may be regarded as analogous to the gall-bladder and the urinary bladder to the duodenum.

The characteristics which distinguish the pains in these passages from the true kidney pain (nephralgia) are the marked tendency to colicky attacks and the tendency to radiation; for we have here in contradistinction to the kidney itself a channel for radiation along the ureter and bladder. The chief causes * which may give rise to colicky attacks in the genito-urinary ducts are analogous to those which give rise to similar pains in the gall-duct system.

1. *Stenotic Processes.*—The most important causes for stenosis are: (a) Calculi, blood clots, particles of new growth, and aortic aneurysm (on the left side). (b) Kinking and torsion. (c) Carcinoma of the bladder at the points of entrance of the ureters. (This would be analogous in the bile passages to carcinoma at the papilla of Vater or in the head of the pancreas.)

---

* Observations in cases of lead poisoning (*v.* page 221) and in phosphaturia lead me to believe that there may also be sensory neuroses of the ureters.

2. *Inflammatory Processes, Ascending and Descending.*—Pyelitis with or without the formation of calculi; this may or may not extend into the small tubules of the kidney (pyelonephritis). Ureteritis is entirely analogous to cholecystitis and cholangeitis, while the pyelonephritis can be compared with Hanot's biliary cirrhosis.

All these conditions, and especially the formation of calculi in the kidney pelvis, give rise to colicky, paroxysmal pains. On the other hand, they may also give rise to more constant pains, not colicky in their nature, the understanding of which is of extreme importance. These more constant pains are probably due to a moderate degree of distention along the ureters or pelvis. It must be remembered, too, that any pathological process in the renal pelvis easily involves the kidney itself, even when it is only a temporary damming back of urine or an active hyperæmia; and this, in its turn, can give rise to the true kidney pain which we have spoken of before.

As a practical matter it is almost impossible to separate the purely stenotic and the inflammatory processes which occur along the renal pelves and the ureters. They often occur at the same time, for stagnation, as is well known, carries with it the predisposition to infection. For this reason we may disregard this purely artificial distinction in the consideration of the pain.

(a) The Formation of Calculi in the Pelvis of the Kidney.—Just as in describing the true kidney pain, the pain caused by infarct of the kidney was

used as a type, so the pains occurring in the pelves and ureters are well typified in a general way by the pains caused by a calculus in the renal pelvis.

For practical reasons it is well to divide such pains into (1) spontaneous attacks of paroxysmal pain or colic, (2) more constant pains not colicky in their character and often elicited by physical examination.

(1) The localization of the colicky pains is rather apt to be confusing to the diagnostician. Sometimes these pains occur first in the region of the gall-bladder along the right costal border. Occasionally they have their seat more deeply in the ileocæcal region or, if left-sided, just above the left Poupart's ligament. In comparatively rare cases the lumbar region may be the starting point of the pains. This is not at all surprising when we consider that the lesion upon which the pain is based has its seat, not in the kidney itself, but in the ureter.

More important than the actual location of the pain is the radiation, which unfortunately is not always present. This occurs into the thigh of the same side, chiefly radiating down the anterior or external surface, and rarely extending further down than the knee.

We must be on the watch, too, for radiations into the bladder and the genitals, with occasional cramp-like sensations in these organs. It is very important to remember that painful sensations in the testicles, ovaries and thighs may for a long time precede the first attack. These pains occur especially at night

and their diagnostic importance must not be underestimated.

The pain not infrequently radiates into the lumbar regions; upward it rarely reaches higher than the angle of the scapula. Whenever the attacks occur spontaneously they seem to be dependent upon mechanical agencies rather than upon digestive causes.

Motions which give rise to a sudden stiffening of the abdominal walls, lifting, or throwing, seem frequently to have a causal relation to the beginning of an attack. On the other hand, I have seen cases in which attacks have been initiated by the drinking of sour wine, the taking of sour food, such as vinegar, and occasionally the drinking of beer. Such digestive influences upon the attacks occur naturally in cases in which, in addition to calculus formation, there is an inflammatory change of the mucous membrane of the pelvis and ureter which is irritated by the reaction of the urine passing through it.

In February, 1906, a man of about twenty years came to me on account of cramps in the stomach. The first attack was said to have come on at the age of three years after a dietary indiscretion. Lately attacks had appeared after periods of constipation or after eating fatty meat. The patient was sensitive to cold water, easily fermentable foods, vinegar, and spices. The cramps would also sometimes follow lifting a heavy object with the right hand. This very fact aroused suspicions as to the patient's own diagnosis of "stomach cramps" made in consequence of the apparent relation of the condition to the ingestion of food, and further examination left no doubt as to the existence of a stone in the left kidney. I saw the patient again a year later and he told me that in May, 1906, he had passed a calculus the size of a pea.

Whenever a paroxysm ceases with great suddenness we are led to believe that a calculus has been discharged into the bladder.

The secondary symptoms chiefly to be considered are those which arise from the urogenital system and therefore point directly to the origin of the colicky attack. Chief among these are desire for frequent micturition and retention of urine. In tuberculosis of the kidney, kidney infarct, and other conditions of nephralgia or true kidney pain, the desire to urinate may occasionally entirely disappear.

Sometimes there is definite sensitiveness of the testicle on the affected side with occasional swelling. Swelling and sensitiveness in the urethra may be the premonition of an attack. Very definite clews, of course, are given by hæmaturia, albuminuria, uraturia, phosphaturia, oxaluria, and cystinuria.

Reflex symptoms, aroused in other organs by the renal condition, may considerably cloud the diagnostic picture. Meteorism with constipation, diffuse distribution of the pains, with collapse, may simulate acute intestinal obstruction and, in just such cases, the extreme sensitiveness of the testicles is of distinct diagnostic importance. The distended abdomen itself is often sensitive to pressure, and in such cases distention and sensitiveness are usually localized more on one side than on the other. Occasionally there may be no pain in the kidney region itself. Diarrhœa may accompany the attacks, and gastric symptoms, such as nausea and vomiting,

occasionally occur, but are much less frequent than in connection with the colics of the biliary system, and, during the attacks of renal pain, the digestive system is often entirely normal, not even the appetite being changed. In many cases there are subjective sensations, such as a sensation of cold, etc., in the thigh of the same side. There may also be motor symptoms, such as spasm in the muscles of the calf or the thigh of the same side.

Sensitiveness to pressure along the ureter on external examination per rectum or per vaginam is of the greatest importance, and from this examination alone the diagnosis of an obstructing calculus can often be made.

(2) More constant pains (without paroxysmal quality). Under this heading we include chiefly pain which is not subjectively present but is discovered on palpation. We have already called attention to the sensitiveness of the testicle. In addition to this there is usually sensitiveness of the ureter, leading on the right side to pain in the neighborbood of the appendix; on the left side in the neighborhood of the sigmoid flexure.

The sensitiveness to pressure in the flank and to percussion in the lumbar region is of great importance.

In one of my cases there was first lumbago-like pain on the right side and the patient kept the body bent over to this side. Some time later there was a typical attack of colic on the right side.

The maximum point of sensitiveness is often located just above Poupart's ligament. Occasion-

ally when the condition exists on the right side the gall-bladder is very sensitive and errors may arise from this fact. When this is the case, however, very often sensitiveness in the gall-bladder radiates towards the urinary bladder and this, of course, is of great importance.

These more constant pains may often be started by the patient's lying on one side. When the process is bilateral lying on either side is painful. In some cases no fixed position can be held for any length of time without great pain. We spoke of such positions of greatest pain when dealing with cholecystitis, and here again symptoms of this kind are due probably to changes in the pelvis of the kidney; they may also be caused by secondary involvement of the kidney in the form either of an acute damming back of the urine, or an acute congestion of the kidney itself. Coughing, deep breathing, and jarring of any kind may give pain in nephrolithiasis.

The unilateral neuralgia of the testicle which occurs chiefly at night, and the so-called rheumatic pains in the thigh, may often precede the true colicky attacks by many years. The sensations of weakness, nausea, etc., which usually accompany the colicky attacks may be present by themselves frequently, and are then, almost invariably, wrongly interpreted.

Under this heading, too, we must consider that pain in the lumbar region which frequently accompanies the condition. This is present especially in the lying and sitting postures, and is less marked

when walking. Alone, of course, the recurrence of such a pain can give us no diagnostic clue; but, in connection with other symptoms, such as testicular pain and paræsthesia of the thigh, it may give much additional support to our diagnosis.

(b) Pyelitis.—Of chief importance are the ascending catarrhs of the urinary passages, usually preceded by a history of an old gonorrhœa, so that in many cases the ureter and the bladder itself may be regarded as diseased together. This variety of pyelitis is the most frequent. The pain occurring in this condition is almost identical with that occurring in cases of calculi. This fact is of particular pathological interest, since it lends support to the opinion that pains of this description are, in these cases as well as in gall-bladder condition, caused by the inflammatory lesions rather than by the mere mechanical pressure of calculi.

Changes of the kidney in all their transitions from a simple inflammatory hyperæmia to a fully developed pyelonephritis may accompany this condition. A part, therefore, of the clinical picture is made up of the true kidney pain itself. The localization of the pain is much the same as that mentioned above. Occasionally, however, cases occur in which the pain and sensitiveness take place in the region of the gall-bladder and appendix and thus lead to error in diagnosis.

The radiation is identical with that which occurs in calculi of the renal pelvis. Radiation may occur at the same time as the colicky attacks or may be

entirely independent of them. It may be localized chiefly on the outer side or occasionally on the inner side of the thigh of the same side. Prolonged sitting occasionally initiates these radiating pains.

In isolated cases it is not so much the sensation of pain as the sensation of weakness and fatigue in the lower extremity of the same side as the disease which gives rise to a suspicion of a lesion in the renal pelvis.

Sometimes sensitiveness occurs along the dorsolumbar portion of the spinal column. Pain occurring while the patient is lying on his side is located usually in the side opposite to that of the lesion. Frequently the pain which occurs in this posture is present only during the acute attack and disappears when the attack is over.

There is often a tendency towards relaxation of the abdominal muscles on the diseased side. The patients lean toward that side while walking or sit in a cramped position. Sudden stretching of the abdominal muscles often brings about an attack of intense pain and syncope, in cases which have been before that almost free from pain. In doubtful cases it is often advisable to test cautiously the influence of lifting or carrying weights on the back. Violent jarring, such as is produced by stamping the foot, jumping, etc., will frequently give rise to pain. In contradistinction to lumbago, the pain is not increased by stooping, even when there has previously been severe pain in the lumbar region.

Catching cold and exposure to wet often give rise to attacks of pain. This is probably due to the fact that these conditions may provoke an acute exacerbation of a chronically inflamed condition of the mucous membrane.

It need hardly be emphasized that careful microscopical examination of the urine and careful attention to the temperature are desirable. Pyemic temperature frequently occurs and the individual paroxysmal attacks may be accompanied by a chill and subsequently sweating. Fever may precede the attacks for some time, for the infectious agent, which not frequently is B. coli or staphylococcus, plays an important rôle in these cases.

The most important secondary symptoms are frequent desire to micturate and ardor urinæ.

(c) Hemorrhage from the Kidneys.—Bleeding from the kidney can unquestionably give rise to paroxysmal attacks of pain, so that the expression *Nephralgie hæmaturique* is fully justified.

It is very important to remember that cases of prolonged and constant hæmaturia exist, so-called "essential hæmaturia," without a lesion in the kidney and without any accompanying pain. Hæmaturia, therefore, gives rise to pain only when other underlying factors are present. The most important of these is the presence of blood coagula (malignant tumors, ulcerative erosions of renal capillaries, as in tuberculosis of the papillæ, etc.). The clots in these cases produce the same patholog-

ical condition in the ureters as calculi, and occasionally cause obstruction. In addition to this, sudden profuse bleeding may cause severe distention and in this way give rise to paroxysmal pains. It is a general fact that under suitable conditions bleeding into hollow muscular organs may by acute distention give rise to paroxysmal pains.

A true kidney pain, that is, nephralgia in the true sense of the word, is occasionally caused by bleeding from vascular tumors of the kidney, by " essential hæmaturia," or by acute exacerbations of chronic nephritis.

November 6, 1903, a roofer, thirty-two years old, stated that three days previously in carrying a weight of forty pounds on his shoulder up to the third story of a house he was taken with pain in the right testicle, along the inner side of the thigh, and above Poupart's ligament. On reaching the third story and putting down his load the pain ceased. An hour later he noticed that the urine was red, and that evening he voided pure blood. There had been no previous symptoms pointing to the urinary tract. On examining the patient the right testicle was found to be tender, and there was a zone of hyperæsthesia along the inside of the right thigh. The bleeding still continued on November 30. Partly by exclusion, and partly in consequence of an active tuberculin reaction, the hemorrhage was held to be the first symptom of a renal tuberculosis, in spite of the absence of pyuria. At the operation in Gussenbauer's clinic on December 1 there was found cheesy degeneration of the two upper papillæ, with erosion of the vessels and dissemination of tubercles over the lining mucosa of the renal pelvis.

Nephralgia in the strict sense of the term may be caused by a sudden rise in intracapsular pressure due to parenchymatous hemorrhage in such conditions as vascular new growths, "essential hæmaturia," or acute exacerbation of a chronic nephritis.

URINARY BLADDER.

The chief characteristic of pain in the bladder is the direct relation which it has to the function of the organ, that is, urination. The problem of diagnosis is simpler by far in this organ than in any of the other hollow muscular organs, since pathological changes in micturition can be closely observed by both patient and physician. The mechanism of the pain, therefore, can be more exactly studied, and the conditions prevalent here can serve to throw light upon similar pains occurring in the gall-bladder and stomach.

The conditions which give rise to bladder pains are the following:

1. Catarrhal and Ulcerative Changes in the Mucous Membranes of the Bladder and the Urethra.—These are chiefly caused by acute and chronic forms of cystitis following urethral infections, inflammatory conditions due to calculi, foreign bodies, tuberculosis, neoplasms, etc. Urethral strictures and enlargement of the prostate, benign or malignant, are important in that they predispose to cystitis.

2. Perivesical Inflammations. — These are chiefly diseases of the female genitals and diseases of neighboring parts of the intestine (rectum and appendix).

The pain is often directly related to the contraction of the bladder muscle and reaches its maximum at the height of contraction, that is, during the end of micturition and immediately after it.

Distention of the bladder wall whenever sudden may also cause great pain. This is closely analogous to conditions existing in the gastro-intestinal tracts and the bile-ducts.

The localization of the pain, both subjective and objective, corresponds to the location of the organ, occurring behind the symphysis. In prostatic disease it is occasionally located in the perineum. Radiation occurs along the urethra and into the glands, into the testicles, and into the inguinal regions. Sometimes the pain radiates into the anus and the perineum. When this happens it may be explained by the common innervation of these regions by the sacral plexus.

Reflexly radiation may occur upwards into the hypochondriac regions, downward into both thighs, and into the regions innervated by the sciatic and the anterior crural nerves. This, for instance, is the case in prostatic tumors.

It must not be forgotten that in rare instances prostatic tumors may occur without pain. The general condition of the nervous system seems to have great bearing upon this feature.

As we have said, bladder contraction is the most important factor in producing the pain. The more forcibly, therefore, this contraction occurs (as in stricture, enlargement of the prostate, and calculi), and the more severe the inflammation of the mucous membrane, the more violent will be the attacks. In cases where the mucous membrane of the bladder itself is intact, and the pain is due only to tugging

on the perivesical adhesions, the attacks are never very severe.

Jarring and sudden changes of position, when they have any relation to the pain at all, point toward the existence of calculi. It is always necessary to examine by palpation above the symphysis and per rectum or vaginam.

Cold drafts, wetting the feet, etc., may reflexly give rise to bladder peristalsis.

The physical and chemical properties of the urine may also exert marked influence upon the pain. Concentration of the urine, as in fever with serous exudation (as in tuberculous peritonitis) or in consequence of severe perspiration, may give rise to pain in an irritable bladder. Spicy food and certain drugs, such as urotropin, in large doses, give rise to similar sensations.

The most important secondary symptoms to be considered are pyuria and bacteriuria. Whenever these two conditions are absent, we should suspect calculi or perivascular inflammations; hæmaturia, too, for obvious reasons, is not rare. Whenever this occurs, together with pains in the bladder, a vascular origin of the pain is most likely. Frequent micturition is, next to pyuria, the most usual of the secondary symptoms.

The fact that the pains are usually in direct relation to the bladder function, makes an error in diagnosis rather rare; yet it is well to remember that the symptoms of disease of the bladder itself are so similar to those of disease of the prostate and pos-

terior urethra, that a separation from these is almost impossible without the aid of objective symptoms. Examination of the prostate is, therefore, essential.

Tenderness of the bladder upon examination per vaginam or per rectum would point to organic disease. The pain occasionally radiates into the rectum and is in direct relation to defecation. This occurs chiefly in diseases of the prostate and in vesical calculi, and may lead to an erroneous diagnosis of intestinal disease. Radiations into the genitals and thighs may occasionally be misconstrued as ureteral colic. Only careful physical examination can guard us against these errors.

It is hardly necessary to attempt to analyze the differences between the pain of these conditions and that dependent on causes operating through the central nervous system, of the nature of the gastric crises in tabes for example, for the possibility of confusion in this respect is seldom likely to occur. Dysuria is sometimes observed, however, in cases of chronic lead poisoning.

In the section of true kidney pains, we called attention to the fact that neoplasms of the bladder may, by obstruction to the ureters, give rise to ureteral colic and sensitiveness of the kidneys themselves on one or both sides. Conversely, tuberculous disease of the kidney may frequently be accompanied by the subjective symptoms of cystitis, and, even when the bladder and urethra are entirely normal, pains may be produced in them by pressure upon the diseased kidney.

SPLEEN.

Pathological processes in the spleen often give rise to pain at extremely early stages of their development, and, in correspondence with the position of the organ, such pain is localized in the left hypochondrium. Since we are dealing with a ductless gland the pains produced here cannot possess the manifold variety of those occurring in organs with muscular ducts. Here there are but two factors to be considered:

1. Distention of the spleen capsule with enlargement of the organ.

2. Inflammation of its peritoneal coverings (perisplenitis).

The conditions which are accompanied by pain in the spleen are chiefly:

(a) *Myelogenous Leukæmia.*—In this condition the pain in the spleen is frequently one of the first symptoms. Sudden and intense pain is caused by inflammation of the capsule with or without the formation of infarcts. Pseudoleukæmia and polycythemia also give rise to pain in the spleen; chlorosis and pernicious anæmia more rarely.

(b) *Cirrhosis of the Liver.*—Splenic involvement is most frequently found in cases of syphilitic cirrhosis, and in such cases the perisplenitis goes hand in hand with the existing perihepatitis. Many of the so-called Banti's cirrhoses (hereditary lues) come under this heading. Splenic pains occasionally accompany Hanot's cirrhosis, but are hardly ever present in the atrophic variety of Laennec.

(c) *Paroxysmal Hæmoglobinuria.*—During attacks of paroxysmal hæmoglobinuria splenic pains may occasionally be noticed.

(d) *Infectious Processes.*—The infectious processes which are most commonly accompanied by splenic pain are typhoid fever and malaria.

Occurring in the left axillary line, the splenic pains in these diseases are often erroneously regarded as evidences of a pleurisy or a lower lobar pneumonia. This error is more easily made since in cases with splenic swelling fine crepitant râles often occur along the line of separation between the lung and the spleen, due to atelectasis of the margin of the lung.

Whenever we are attempting to obtain a history of a previous attack of malaria, it is well to inquire whether at the time of the chill there were pains in the splenic region. Sharp pains along the right costal border often occur together with these and are due to hepatic swelling.

Pain on palpation along the left costal border in a patient who is running a temperature and in whom we can exclude pleurisy and subphrenic abscess, usually points to marked swelling of the spleen.

(e) *Heart Disease.*—In patients with heart lesions (mitral stenosis, etc.) acute pains occurring in the region of the spleen or sensitiveness in the intercostal spaces corresponding with the position of the spleen, should always arouse the suspicion of splenic infarction. This suspicion is strengthened by symptoms of emboli in other regions (renal arteries, etc.).

Progressive increase of the pain in a case of recent endocarditis points to the possibility of secondary abscess formation.

Since the position and size of the spleen are subject to great variation in the different pathological conditions, it is natural that the exact topography of the pains should show corresponding variation. In all cases, however, the pain is felt in the left side along the lower thoracic and upper abdominal regions. Whenever pain occurs in this situation examinations should be made for sensitiveness under the left costal border and in the lower intercostal spaces from the eighth downward.

Splenic tumors may occasionally give rise to dorsal pain, especially after prolonged lying on the back. When the spleen is so large that it sinks for any considerable distance below the costal border, as in leukæmia for instance, it is important to determine whether the sensitiveness is of diffuse or circumscribed nature. Circumscribed pains of this description are occasionally due to splenic infarct or local perisplenitis.

Every now and then pain occurs along the angle of the left scapula or between the shoulder blades. In some cases there is marked pain in the left shoulder, often so severe that motion of the left arm becomes difficult.

Such radiations may occur spontaneously or may be caused by sudden stooping, trauma, or lying on the left side. In such cases localized points of sensitiveness can be determined. The most common situa-

tions of these are over the acromion process and at the junction of the external and middle third of the upper edge of the trapezius muscle. The conditions prevalent here are exact counterparts of those existing in the right shoulder with perihepatitis.

The quality of the pain is usually described by the patient as stabbing or tearing. Mechanical motions often initiate attacks of pain. The mechanical factors to be considered are:

1. *Compression of the organ* produced by stooping, quick turning to the left of the trunk upon the hips, lifting of the left arm, etc. In contrast to this, relaxation of the abdominal muscles relieves the pain, and in consequence patients often walk in a stooping position. Palpation and percussion influence the pain in a similar way.

2. *Change of Position of the Organ.*—Lying on the left or right side usually produces pain and a sensation of tension in the left side. This is especially the case when the stomach is empty, the full stomach acting as a sort of cushion. For obvious reasons deep breathing will cause pain when perisplenitis is present.

3. *Sudden Jarring.*—All varieties of jarring will give rise to pain, prolonged walking, running, riding in a carriage, hiccoughing, sneezing, etc.

Occasionally, besides the mechanical means of starting the pain, digestive conditions will influence it. Abnormally large quantities of food will give rise to pain by causing secondary hyperæmia of the organ. This is especially the case when inflamma-

tory adhesions exist between the stomach and the spleen.

The influence of drugs on the diagnosis is not negligible since the pain caused by increased tension of the capsule is diminished by all those drugs which produce a diminution in the size of the spleen. Such are arsenic and quinine.

The most frequent secondary symptoms occurring with splenic pain are increased size of the spleen as detected by percussion and palpation, friction sounds produced by perisplenitis, and a systolic murmur heard over the splenic vessels.

The most important condition to be considered in differential diagnosis is pleurisy. Differentiation is especially difficult in the case of acute disease, such as malaria and typhoid fever. The pains in these cases are felt in the axillary and intercostal regions. They are dependent upon deep breathing. Lying on the left side is usually painful and occasionally produces a cough. There are fine crepitant râles over the area of pain, due to atelectasis caused by the large size of the spleen. By these signs one is led to suspect pleurisy or early pneumonia and to forget the fact that the pain may be due to an increased tension upon the splenic capsule.

In the same way infarcts of the lung and spleen may often be mistaken for one another in patients with heart disease. In such cases examination of the spleen reveals its sensitiveness. Much information, too, can be gathered by careful examination of the intercostal spaces in the axillary line in order to

determine whether or not they are sensitive. When the condition is one of splenic pain the sensitiveness in the intercostal spaces is limited pretty well to the area of dulness of the organ.

Splenic pain is occasionally misinterpreted as arising in the stomach, since, as has already been mentioned, the taking of food often increases the pain or initiates an attack. In a general way this can be avoided by remembering that in splenic conditions the quantity of the food, entirely independent of its quality, gives rise to an attack. In cases where radiation of the pain into the left shoulder takes place, a diagnosis of articular rheumatism is occasionally made. The absence, however, of change in the joint itself, the entire freedom of motion, and the determination of the above-mentioned points of tenderness (at the acromion and along the border of the trapezius) will aid in the differentiation.

CHAPTER IX.

Respiratory and Circulatory Systems.

THE LUNGS.

Pain may unquestionably occur in the trachea and the two main bronchi. At any rate, it is customary to interpret the retrosternal pain occurring almost regularly with acute bronchitis during the stage of dryness and congestion, as emanating from these organs. On the other hand, distinctive processes which involve the air vesicles of the lung, such as lymphosarcoma and pulmonary abscess, may run their entire course without any pain. It is, therefore, perfectly safe to claim that lesions occurring in the parenchyma of the lung itself do not give rise to pain.

The production of pain in disease of the lung is, therefore, dependent entirely upon involvement of the pleura. This, of course, is most frequently of an inflammatory nature.

These simple facts give the key to the comprehension of all pains which occur in connection with pulmonary disease and permit us to understand their nature and radiations.

It must not be forgotten that the visceral and parietal pleura are in very intimate relation with many nerves (brachial plexus, intercostal and phrenic nerves), and that they likewise have close anatomical relation to the intercostal muscles and

diaphragm. For these reasons the occurrence of secondary neuralgias and myalgias is more than likely.

Since, therefore, the pains accompanying all the various lesions of the lung are dependent upon the inflammatory pleurisy, it is simplest to describe them all together in a general way, pointing out, as we proceed, the various features of differentiation.

As regards localization, these pains correspond almost exactly with the situation of the pleural inflammation, and the greatest intensity of the pain, both subjectively and objectively, coincides with the most marked auscultatory sounds.

Disease of the pleura over the upper lobes (tuberculosis and neoplasms) evidences itself chiefly by pain in the region of the shoulder, in the supra- and intraclavicular fossæ and in the supraspinous regions. These pains should be looked for especially in cases in which we suspect early tuberculosis.

The pains in the shoulders, which so often occur in tuberculous patients at the very beginning of the disease, are probably caused in most cases by the adhesions at the apex of the lung found so frequently at autopsy. The inflammatory process occurring along the summit of the pleura may involve secondarily the brachial plexus and the upper intercostal nerves. For this reason tenderness along the brachial plexus and along the upper intercostal spaces is frequently present in cases of tuberculosis and is in many cases one of the first symptoms. The point of tenderness which was mentioned as a reflex

symptom of hepatic and splenic enlargements (at the junction of the outer and middle thirds of the upper border of the trapezius muscle) can occasionally be demonstrated in these cases as well.

It need hardly be mentioned that carcinoma developing in the apex of the lung might give rise to secondary injury of the brachial plexus and consequent neuralgia in the arm.

When the pleura are diffusely diseased, as in pleurisy and pyopneumothorax, the subjective pain and tenderness often fail to show a correspondingly diffuse character. On the contrary, they are usually located in the axilla or in front, rarely posteriorly, and, when this does occur, only in the last intercostal spaces.

This is due to a number of causes. Chief among these, probably, is the fact that the respiratory excursions of the lung reach their greatest development at the bases and thus the greatest motion of the pleural leaves upon each other takes place in the costophrenic sinuses.

Whatever the reason may be, the facts remain that pains which arise in the pleura are frequently found only in the axillary line, and that sensitiveness to pressure is limited to the area below the fifth intercostal space. The latter fact may in part be due to the absence of a muscular covering over these spaces.

Occasionally, cases of diffuse pleurisy and pleuropneumonia of the lower lobe occur, in which the tenderness is limited to the abdomen, just below

the costal border. This may lead to errors in diagnosis. In such cases upward pressure in the flank, hypogastrium, and (in right-sided cases) even the ileocæcal region, will give rise to pain.

This peculiar distribution of the pain is probably due to involvement of the diaphragmatic pleura. The diaphragm forms a sort of bridge across which the thoracic pain enters the abdominal regions. Even the subjective pain in pleurisy may in a good many cases be localized along the costal border.

One of the favorite seats of pain in left-sided pleurisy is the region of the heart apex. This may be due to the fact that during systole the apex of the heart, by friction, increases the inflammation and, therefore, in spite of the diffuse nature of the pleurisy, may give rise to circumscribed pain.

Retrosternal position of the pain is rare. It does occur, however, and is usually associated with inflammation of the mediastinal pleura and with lesions of the mediastinal lymph nodes. In such cases, however, it would also be necessary to think of pericarditis.

The pain occurring in the interscapular space in pulmonary tuberculosis may also occur in diffuse pleurisy.

The quality of the pain is rarely characteristic, and it is very difficult to differentiate it from that of intercostal neuralgia or myalgia. As a general rule we must say that the pain is of a sharp and stabbing character.

Special characteristics of the pain are present only in rapidly developing pneumothorax, where the pain, just like the pain accompanying perforation of the gut into the peritoneum, is extremely acute and diffuse, and involves the entire half of the thorax. Added to this there is a peculiar sensation of internal soreness or tearing. Similar pain, however, may be observed in subpleural cavities without perforation, and the confusion may be increased by the occurrence of collapse. Similar acute attacks of pain occasionally accompany the perforation of an empyema.

The factors most markedly influencing the pleural pain are:

1. *Pressure.*—There are cases of pleurisy in which even a light touching of the skin of the thorax with a needle, with the bare hand, or with the bed-cover, may give rise to the most intense pain (empyema). On the other hand, there may be all transitions from this extreme condition of sensitiveness to an absolute lack of pain. The factor determining this, of course, is the degree of acuteness and severity of the inflammatory process. The condition is unquestionably analogous to a similar condition in the peritoneum. The area of sensitiveness to pressure is usually much more diffuse than the area of subjective pain. In every individual case it is important to observe the zone of sensitiveness and to observe its increase or decrease during the course of the disease. In pleuropulmonary disease the pain which occurs in the abdomen is hardly ever spontaneous and is dis-

covered only by examination. While the diaphragm, as mentioned above, is usually the means of transmission of such pain to the abdomen, in right-sided lesions it is always necessary to consider the possibility of secondary liver pain due to perihepatitis or hepatic congestion.

Sensitiveness to pressure is limited chiefly to the axillary and anterior aspects of the thorax, and favors the lower intercostal spaces. This is true at any rate of cases of acute pleurisy. In apical tuberculosis when pleural adhesions are developing, the sensitiveness to pressure is usually localized in the subclavicular or subspinous fossæ, and in the upper anterior intercostal spaces. The same is true of cavity formation in apical tuberculosis. These objective pains are of especial importance for early diagnosis, since they may appear when subjective pains are still absent.

The pain may be definitely ascribed to a pleural lesion whenever sensitiveness to pressure and crepitant râles are found in one and the same spot. It is occasionally difficult to exclude intercostal neuralgia. (For a discussion of this refer to the chapter on the subject, page 107.)

Whenever pressure upon the rib itself is painful, it is obvious that (having excluded periostitis) we must assume the existence of a secondary intercostal neuralgia.

In pericarditis the pain seems to be chiefly subjective, modified little, if at all, by pressure; it is

located more anteriorly and retrosternally, rather than in the axilla.

2. *Position and Motion.*—Lying upon the diseased side causes pain by direct pressure. For a consideration of this position, therefore, the remarks made in the preceding paragraphs may be consulted.

When the patient lies on the healthy side, however, different conditions prevail. In this position the patient frequently suffers great distress, which gives him the impression that the pain is drawing over into the healthy side.

Such sensations are chiefly present in cases of pleural exudate, more rarely with cavities, and must be ascribed to a shifting of the organs in the mediastinum. When the patient lies upon the healthy side, also, the work of the diseased side is increased and the pain occurring with respiration is necessarily greater. In some rare cases lying upon the abdomen relieves the pain. (This was the case in a patient with pleural pain in the neighborhood of the heart apex.)

The pain is increased when the patient is upright and his head is bent forward. This is due to the increased costal respiration. Stooping occasionally gives rise to pain.

3. *Inspiration and Expiration.*—Coughing and sneezing come under this heading, since all these forcible movements in the pleura presuppose an analogous action of the muscles of inspiration.

In cases of pyopneumothorax, however, there is no increase of the pain with deep inspiration. This

is, in part, due to immobilization of the corresponding half of the thorax, and in part to a lack of contact between the leaves of the pleura.

Whenever a chill or any febrile movement is followed by sharp pain in the axillary regions, the diagnosis of pleural pain is obvious, and the first suspicions are, of course, of pneumonia or pleurisy. Yet it is important to remember that occasionally a malarial chill is accompanied by pain in the lower intercostal regions and in the axillary portions of the left chest. These pains we have already referred to as emanating from the spleen and due to tension in the splenic capsule. The presence of herpes and the fine crepitant râles of atelectasis at the base of the left lung (pushing upward of the diaphragm by the enlarged spleen) increase the possibility of error.

Whenever pains occur along the lower portions of the thorax it is wise to think of the subdiaphragmatic organs and their appendages.

The sensitiveness which accompanies acute right-sided pneumonia and pleurisy is occasionally localized in the ileocæcal region. This is especially frequent in children and may lead to a false diagnosis of appendicitis.

The interpretation of thoracic pains is far more difficult in chronic conditions which run their course without fever. In such cases it is always difficult to decide whether the pains have a pleural origin (such as the chronic pleural adhesions so often found in tuberculous individuals) or whether we are

dealing with an absolutely independent neuralgia or myalgia.

When there have been very severe coughing spells it is always well to think of myalgia due to fatigue (analogous to the pains in the calves of the legs following long walking tours). It is perfectly obvious that the pain due to a muscular or nervous cause may be initiated by the same factors that give rise to pleural pain (respiration, etc.). On the one hand, there may be absolutely no physical signs in the chronic adhesive pleurisies; on the other, the pain in intercostal neuralgia, by limiting respiratory excursion, may lead to secondary atelectasis with crepitant râles. It is very important, therefore, to determine whether the lower border of the lung moves properly with respirations. Examination of the domes of the diaphragm with X-ray is also advisable.

Careful differential diagnosis in all these cases is almost impossible, but there are a number of points which may be of great help.

1. One-sided objective or subjective pain, localized in the axilla, points with great probability to a pleural origin.

2. The same is true of one-sided pain limited to the apex of the lung, especially when this is accompanied by anæmia, emaciation and neurasthenia, even when the physical examination of the lung is negative.

3. Careful investigation of the previous history must be made as regards overexertion of the muscles

of the arm or chest, and exposure to draughts. Inquiry must be made as to rheumatic or neuralgic tendencies, and symptoms of these diseases in other parts of the body must be looked for. These, when present, point toward neuralgic or myalgic origin of the pain.

4. Whenever lying on the diseased side causes coughing, it is obvious that the pain emanates from the pleura.

In the preceding section we have differentiated pleural pains from those not localized in the pleura, but we have paid no attention to the differentiation of the specific pleural lesions which may produce such pains.

In cases in which there is unquestionably a lesion of the lungs and the pleura, the exact nature of the lesion can be determined only by careful analysis of the pain. The very absence of pain in such cases is of great diagnostic significance. Thus, whenever large areas of dullness occur entirely without subjective or objective pains, although it is not possible absolutely to exclude inflammatory pleurisy, nevertheless it is advisable to think of neoplasms, echinococcus, dermoid cysts, and pulmonary abscesses, processes which are not necessarily accompanied by severe inflammations along the pleura and may therefore develop with little or no pain. Dullness along the base of the lung without sensitiveness over the lower intercostal spaces points to the existence of a subphrenic abscess.

Symptoms of pneumonia with infraclavicular pains should lead us to think immediately of a beginning apical pneumonia.

Analysis of the pain often aids in differentiating a cavity from a pneumothorax, a differential diagnosis which is sometimes extremely difficult. This is true, too, of cases in which we are trying to decide whether a sudden profuse expectoration is due to the evacuation of a cavity or to the rupture of a sacculated empyema. In the latter case the act of rupture is accompanied by intense pains and the sensitiveness along the intercostal spaces corresponding to the sacculation is immediately diminished, just as after the incision of an abscess.

Cavities, on the other hand, since they are more centrally situated, hardly ever lead to much sensitiveness of the corresponding costal spaces, and give rise to no attacks of pain during the act of evacuation.

AORTA.

The phenomena which have occupied our attention in the preceding chapters, pains occurring in the alimentary tract, liver and kidney, have had three fundamental factors in common:

1. Local spasm in a hollow muscular organ.
2. Local distention of its capsule or walls.
3. Inflammatory processes in their serous coverings.

The second and third of these factors, as we have seen, may combine in many of these conditions.

It is beyond doubt that diseases of the thoracic or abdominal aorta (such as aortitis or aneurysm) may give rise to pain. The question naturally arises, therefore, whether the mechanism of this pain is entirely a new one, or whether it is caused by factors similar to those occurring in the other conditions.

Anatomically, the severe inflammations of the aorta may involve the vessel wall in toto or in part. Such inflammatory conditions are comparable with the third factor given above.

It is a matter of fact, too, that added to the inflammatory processes constant or paroxysmal overstretching of the inflamed aortic wall may occur (by aneurysm or increased tension). The condition of tension may be chronic (arteriosclerosis), or there may be a sudden increase of pressure with increased action of the heart and increased resistance in the capillaries (vasomotor disturbances, such as cramps or paresis). These conditions are comparable to those mentioned under the second group (see above) which dealt with overdistention.

Since, therefore, we have the two elementary factors, two and three actually present and frequently acting in unison, the question arises whether the sympathetic nerve endings embedded in the vascular wall are capable of conveying painful sensations. This question can be answered decidedly in the affirmative. Definite affirmative evidence is offered by the pressure pain which is found in inflammatory processes of the peripheral arteries

(carotid, etc.). Similar support for this opinion is found in the tenderness which unquestionably occurs in the suprasternal fossa over the aortic arch or over the abdominal aorta, in conditions of chronic aortic inflammation.

The etiological factors in aortic pain are, therefore: 1. Inflammatory and degenerative processes in the aortic wall. 2. A condition of hyperæsthesia of the sympathetic network embedded in the aortic wall. 3. Chronic or temporary, local or general, increase of internal pressure in the aorta.

These factors need not necessarily occur in combination, but when present in combination, of course, produce the most favorable conditions for the occurrence of pain. Thus, *a priori,* we may assume that two and three together would be sufficient to produce attacks of pain in individuals of a neuropathic temperament.

The fact that occasionally aortic processes may run their course without pain does not contradict these statements. One might just as well say that articular inflammation is not the cause of the pains of arthritis because occasionally a case of arthritis runs its course without pain.

The conditions of primary importance in this connection are usually spoken of as "angina pectoris." The name is purely symptomatic and has no relation to the etiology.

The mechanism which gives rise to the pain in these cases may be subject to considerable variation. The anatomical basis underlying the pains of angina

pectoris (excluding, of course, all those cases which are essentially neuralgic) seems to consist of two main features. These are disease of the wall of the aorta itself (the ascending aorta and arch especially) and disease of the coronary arteries.

There can be little doubt about the production of pain by disease of the aortic wall. Such pain may be of many kinds, and angina pectoris is, in a way, only a special form of aortic pain. Chronic dilatation of the ascending aorta or of the aortic arch frequently gives rise to constant pain which, in its localization and radiation, is entirely similar to that which characterizes attacks of angina pectoris.

We have already called attention to the fact that the general etiology of the aortic pains stands in close analogy to the pains produced in other organs. Quite frequently severe attacks of angina pectoris can be explained at autopsy by gross pathological lesions either of the coronary arteries themselves or of their mouths (usually narrowing of the entrances to the arteries by atheroma or vegetations). Etiological relationship unquestionably exists between these lesions and the attacks. Nevertheless, in many cases there is, at the same time, gross pathological change of the aorta itself, and it is hard to decide which of the symptoms are due to the aortic lesions and which are more directly referable to the disease of the coronary arteries. Generally speaking, it is quite likely that the coronary arteries are more directly responsible for the attacks, for it is probable that, during these, ischæmia of the heart muscle

occurs, resulting in a condition more or less analogous to intermittent claudication. It seems to me, for this reason, that whenever attacks of angina pectoris are accompanied by signs of cardiac insufficiency, irregular pulse and general collapse, it is logical to think primarily of disease of the coronary arteries.

The problem is much more difficult when with severe attacks of pain there is no cardiac insufficiency. In such cases the heart is usually regular, the pulse is full and of good force, and it is likely that, when this occurs, the pain is of purely aortic origin, without coronary involvement.

General Symptoms.—The pains which accompany aortic lesions are, in a general way, alike, in spite of the variety of pathological conditions upon which they depend.

They are situated usually over the diseased organ, and, therefore, are felt in most of the cases retrosternally. Sometimes there is only a feeling of slight discomfort; in other cases there may be an extremely painful sensation of oppression.

The conditions for diagnosis are very much more difficult here, of course, than in other organs, because direct examination by palpation is impossible. This should, however, be attempted as well as practicable by pressure into the suprasternal fossa and upon the abdomen.

Acquaintance with the most common directions of radiation is important, since radiating pains may occasionally occur without other symptoms. Radia-

tion is usually along arterial channels, especially when the aortic process is continued, as in arteritis, into other vessels (carotid and subclavian). In such cases the vessels involved are sensitive to pressure.

Tugging on the vessels by turning the head or lifting the arm is painful, and subjective pain possibly due to vascular spasms may be felt to extend even as far as the branches of the larger trunks. When the carotid artery is the channel of radiation, symptoms may occur in the parts supplied by this vessel. There are occasionally unilateral or bilateral pains in the teeth of the upper and lower jaws. Radiation may occur into the temporal artery and, in addition to pain, may give rise to buzzing in the ears. When the subclavian is involved similar symptoms may occur in the upper extremities.

It is quite reasonable, therefore, to assume that the radiations accompanying aortic pain occur along vascular channels. This, however, does not exclude the possibility that radiations may occur along the brachial plexus and the intercostal nerves as well. Frequently the left brachial plexus is exquisitely tender, both during and between attacks. This may in part be a reflex pain, but in part certainly it is due to direct mechanical injury of these plexuses (large aneurysms).

Pains in the brachial and cervical plexus, of course, can hardly be explained by direct mechanical injury.

Again, pains in aortic disease can be explained on the basis of localized nutritive disturbances,

brought about by diminished blood supply. This is especially probable when fever or metabolic disease is present. Such nutritive changes may be caused by independent lesions in the arteries branching out from the diseased aorta, and then would be simply accidental incidents in the clinical picture. But they may also be more directly related to the aortic lesion, in that the mouths of the large branches may be narrowed. Such narrowing occurs quite frequently at the mouth of the left subclavian artery in cases of chronic aortitis, and occasionally leads to complete stenosis. In patients who are at the same time suffering from rheumatism and gout, these localized nutritive changes are of especial importance. The two conditions together—metabolic and aortic disease—bring on pains in the region of the shoulder girdle and in the thoracic walls; and while the pain is actually caused by the secondary condition (gout and rheumatism), it finds its ultimate explanation in the aortic disease. Such an analysis may seem a trifle overrefined, but it is extremely important in the treatment of the pains.

In a large majority of the cases of aortic disease, a definite history of syphilis can be elicited. This is especially true in patients who are still below middle life. Whenever apparently rheumatic pains occur in the shoulder or along the upper extremity in such individuals, the pains are probably, as a whole or in part, dependent upon atheroma of the thoracic aorta; such suspicions are definitely strengthened by the discovery of other symptoms of aortic disease,

such as increase of arterial tension, aortic pulsation in the suprasternal fossa, etc.

The radiating pains considered above are usually associated with more centrally situated pains which correspond in their localization with the diseased portion of the aorta. Along the ascending aorta they occur chiefly as deeply situated sensations of pressure along the lower end of the sternum. When the arch of the aorta is diseased the pains are situated along the manubrium, while disease of the descending aorta causes pain chiefly in the back between the two scapulæ. These last pains are situated usually to the left of the vertebral column. Disease of the abdominal aorta occasionally gives rise to pain in the left loin or in the epigastrium.

There is thus great variety in the topographical characteristics of the aortic pains. Although in general they are localized in the thorax they are present occasionally in the neck, head, and upper extremities, following in part the vascular channels and in part the nerve trunks.

The factors which give rise to attacks of aortic pain are very few, and for this reason they are of extreme importance diagnostically.

While the causes leading to an attack may seem to be of many kinds, yet, upon closer analysis, they will all be found dependent upon a temporary increase of the strain put upon the aortic wall either by an absolute or by a relative increase of the intra-arterial pressure. The causes initiating an attack may be of an extremely transitory nature, just as a

single forcible clenching of the teeth may give rise to a prolonged paroxysm of trigeminal neuralgia.

The chief factors to be considered are:

1. Increased muscular exertion, such as rapid walking, lifting a weight, walking upstairs, rapid turning in bed, playing the piano, etc.

2. The position of the body. The horizontal position, for instance, produces slowing of the pulse, and is usually accompanied by a greater volume of cardiac contraction, and consequently increased pressure. In cases of this description the patient usually experiences relief on assuming the sitting posture. One of my patients, however, found that he could secure greater comfort by bending the body forcibly backward.

3. Unusual distention of the stomach and intestine. Improvement occurs usually after vomiting and the expulsion of gas or fæces. Severe attacks of aortic pain can unquestionably be caused by chronic constipation and meteorism, by excessive meals, especially when taken in the evening, and by the ingestion of flatulent food. These considerations are of extreme importance and require attention both in warding off the onset of attacks and in attempting to relieve them when already present.

The explanation of this, in many cases, probably lies in the high position of the diaphragm accompanying abdominal distention. In consequence of this there is diminished respiratory suction upon the

large veins, which leads to stasis. This, reflexly, by way of the medulla, acts upon arterial conditions which naturally affect the aorta. Prolonged and rapid expiration, such as accompanies continued speaking, seems occasionally to have somewhat the same effect.

4. Chemical poisons: Alcohol, nicotine. lead, gout and rheumatism are etiological factors of considerable importance.

One of my patients found that smoking a cigarette after breakfast would bring on an attack, and in the case of another the seizures increased in frequency and severity after the instillation of atropine into the eye.

5. Temperature. The extremes of temperature act in the same way. Hot rooms or cold draughts, cold sponging, cold bed, etc., may give rise to aortic pain or may occasionally alleviate existing aortic pain; in some cases the harmful influence of cold weather is undeniable. Steam baths are sometimes remarkably well borne, but in general must be regarded as being contraindicated.

6. Psychic influences (excitement, bad dreams). While these influences are chiefly important in their relation to the functional aortalgias, they may nevertheless be of significance also in pains of true aortic lesions. Here, however, they are of less importance than other influences, though every organic disease, and especially any morbid process that is connected

intimately with the circulatory apparatus, is necessarily more or less in close functional relation to the nervous system.

7. Pains in other organs which lead to consequent increase of blood pressure. Among the conditions particularly likely to come in question are cholelithiasis, gastric ulcer, etc.

One patient under my care regularly had an attack of angina before each menstrual period.

There is no characteristic time for the occurrence of the attacks of angina pectoris. Whenever the condition is based upon actual organic disease, attacks can often be produced with the regularity of well-planned experiments, if any one of the factors just mentioned is exerted with sufficient energy. This regular dependence upon clearly distinguishable causative factors is the chief differential characteristic between the functional angina and that of the true organic variety.

In rare cases attacks may occur regularly at night or during the early morning hours, and these may be explained by the horizontal position of the body and the sudden change of this position during sleep. The occurrence of distressing dreams may also be of significance in explaining the onset of nocturnal seizures.

In patients suffering from metabolic disease the attacks are especially frequent at night and during the early morning. In many cases they occur during

the hours of the first physical activity and decrease during the course of the day. This is probably due to the fact that occasionally the pathological lesion in the aorta is actually caused by the metabolic condition (gouty arthritis).

As the disease progresses the seizures are prone to increase in frequency and as time goes on the intervals between the attacks steadily become shorter and shorter.

Chief among the secondary symptoms found with aortic pains is increased arterial tension. In cases where the attacks are characterized by collapse and where they are dependent more directly upon coronary arteriosclerosis, this does not hold good. The pulse and respiration may be either increased in frequency or slowed.

Pulmonary œdema does not form part of the typical clinical picture, but is not an infrequent complication in cases where for any reason there is an already existing tendency toward pulmonary congestion.

The patients themselves during the attack may seem slightly frightened, or they may go into collapse with nausea, trembling, and severe perspiration. The characteristic aspect of patients with the most severe attacks is silent terror and an expression of the greatest alarm. Such cases are often complicated by disease of the coronary arteries, and are in marked contrast to the loud, melodramatic

behavior of patients suffering from the functional forms of aortic pain.

The paroxysmal attacks of vascular pain which we have just considered may be regarded as the most severe development of the disease. All degrees of pain, however, may be found accompanying the various aortic lesions. These are best considered in direct connection with the various pathological processes.

Aneurysm of the Aorta.—The pain produced by aneurysm is at first probably due to the stretching of the diseased aortic wall. On the other hand, it may also be due to the progressive nature of the process, an extension quite analogous to that occurring with malignant new growth. The diffuse and even distention of the aorta may give rise to pain independently of further extension. The cases of chief interest to us here, however, are the progressively extending ones.

The mechanism of these pains is the same as that which we described in speaking of aortic pains in general; but here we have, in addition to other factors, the element of progressive extension of the aneurysmal sac and consequent pressure upon sensitive structures. This source of pain must especially be considered in cases which are accompanied by constant pain, and a recognition of this will, of course, materially influence prognosis.

Patients suffering from aneurysms occasionally suffer from a pain in the shoulder or in the upper extremity, which comes and goes irregularly. Such

variation makes us question the correctness of our diagnosis. The irregularity can often be explained, however, by temporary exacerbations in the inflammatory process of the aorta and the perivascular inflammations. These pains usually correspond absolutely with the position of the aneurysmal sac. Therefore they are located with especial frequency along the clavicle and are accompanied by sensitiveness in the corresponding brachial plexus, the upper intercostal spaces and ribs. Occasionally pain may occur opposite the coracoid process in Mohrenheim's fossa. When it extends into the back, it is usually situated over the left scapula, in the space between the scapula and the vertebral column, or just below the scapula angle. Occasionally there may be pain in the supraspinous fossa.

Retrosternal pain in the region of the heart, in the shoulder and upper extremity and in the intercostal spaces, however, is so common in simple chronic aortitis that it is hardly necessary always to think of aneurysm when this occurs. It is logical to think of aneurysm only when the symptoms are constant and no free intervals occur. The same considerations apply to the pains radiating into the neck and occipital region. It is the constancy of the pain rather than its localization which makes the differentiation between chronic aortitis and aneurysm. The factors modifying the pain in aortic aneurysm are the same as those mentioned in speaking of simple aortic pains.

Whenever pain in the shoulder is complained of, diagnosis should be made with extreme care. Such pains often occur as an early symptom of aneurysm, but are frequently interpreted as rheumatic, and the treatment to which the patient is subjected (massage, gymnastics, and hot baths) directly aggravates the aneurysmal dilatation. Especial care should be taken to determine whether the pain is increased by forcible exertion, rapid walking, or running upstairs, and improved by rest; or whether a paroxysm is accompanied by cardiac symptoms, such as palpitation, etc. When the pain is due to aneurysm, too, the motions of the shoulder joint are usually free; this, however, is not a very useful point since there are many exceptions, cases in which this reflex pain in the shoulder joint leads to limitation of movement. Rotatory movements of the shoulder in such cases, especially abduction of the arm from the chest above the horizontal position, often lead to pain in Mohrenheim's groove. This may possibly be due to direct tugging upon the subclavian artery. Similar tugging upon the carotid by turning and backward bending of the head may produce pain in the neck and occiput.

The error of confusing the shoulder pain produced by aneurysm with rheumatic pain is especially frequent because exposure to cold and draught often produce an exacerbation, and a local counter-irritation is often followed by distinct improvement. It is not at all out of the question that in many of these cases there may actually be rheumatic or gouty pains

in the joints, since there is often such a diathesis underlying the vascular disease. The shoulder joint is unquestionably in such cases a point of least resistance because of the diseased arteries which supply it.

A very important diagnostic feature of the pains accompanying aortic aneurysm is their reaction to changes of position of the body.

In speaking of general aortic pains, we called attention to the fact that there is a marked difference between the upright and the prone positions in their influence upon arterial pressure. There are, on the other hand, cases of aneurysm in which mere shifting of position when the patient is lying down will influence the pain; these are entirely analogous to similar phenomena occurring in the abdominal conditions, such as gastric ulcer and renal disease. Lying upon the side is often accompanied by great pain, which is usually present when the patient is lying on the side opposite to the lesion. This gives him the sensation of something sinking toward the healthy side. This is unquestionably due to the change of position of the aneurysmal sac and traction upon the periarterial adhesions. It is very important, therefore, in cases suspicious of aneurysm, to observe the influence of changes of position upon the pains.

Theoretically it is quite obvious that any agencies which would exert traction upon the sac, such as deep breathing, coughing and sneezing, would give rise to pain, and practical experiments bear this out.

The pain may be especially dependent upon respiration, and it is of particular diagnostic significance when deep breathing gives rise to extrathoracic pains (for instance, in the back of the neck).

The pain occasionally accompanying the act of swallowing is probably explained by the motion of the larynx during this act, and consequent traction upon the left bronchus and tugging upon the aorta. This pain occasionally radiates into the shoulder blade or into the intraclavicular region.

Percussion and palpation over the intercostal spaces, the ribs and the vertebral column in the region of the aneurysm occasionally produce great suffering.

While the aneurysmal process is an entirely constant state of affairs, the pain need *not* be entirely constant. Variations are especially frequent in those pains which are based upon reflex causes (brachial and cervical plexuses, subclavicular and carotid regions).

Variations, too, in the pathological conditions underlying the pains explain such changes. These are chiefly changes in dilatation of the aneurysmal sac and fluctuations in the inflammatory process occurring in the aorta. These fluctuations may be very similar to those occurring in rheumatic conditions. Changes in the pain may be due, on the other hand, directly to variations in the occasionally complicating rheumatism.

The quality of the pain is not at all uniform. Usually the patients complain of pulsating, boring

pains, or, again, of a shooting or stabbing as with needles. Almost invariably they localize their pains deeply.

We may frequently be led in the right direction by considering the regions secondarily involved in aneurysmal pain, the shoulder pains being particularly important. In this connection special attention must be paid to the mechanical influences of motion or body position, which will help us tremendously even when other secondary symptoms are absent.

Other important symptoms which are occasionally associated are variable hoarseness, which is directly dependent in its intensity upon physical exertion, difficulty in swallowing, especially the swallowing of cold fluids, and associated especially with particular positions of the head. There are often, too, a dry hacking cough, which is influenced definitely by the position of the body, cardiac palpitation, and increase of the shoulder pain following rapid walking, variations in the pulse, sometimes referable to the sympathetic system, and dilated veins.

For rapid diagnosis it is always important to examine the aorta carefully in the suprasternal fossa and in the intraclavicular space on both sides by palpation and inspection.

Chronic Aortitis.—In cases of aneurysm of the aorta we had to deal chiefly with a constant pain. In the cases of chronic aortitis, on the other hand, we deal with a characteristic paroxysmal pain. The

chief condition under consideration here is that which is known commonly as angina pectoris, and which is unquestionably often accompanied by disease of the coronary arteries. In order to avoid repetition we may refer to the section upon aortic pains in general. We have already called attention in that section to the secondary pains and to their channels of radiation.

The considerable variations in the localization of the attacks may be due to the varying localization of the disease in the aorta. The central point of these attacks of pain, that is, the locality from which the attack emanates, is frequently below the sternum. Often the pain is in the lower portion of the sternum and extends symmetrically on both sides, covering thus an oval area; more rarely it extends to the suprasternal fossa. Occasionally, again, the attack may begin with stabbing pains in the heart itself or in the right mammary line.

The point of origin does not, however, occur always in the thorax. It may be located in the epigastrium, and these cases are the ones which are the most easily misinterpreted. Radiation most frequently occurs retrosternally in an upward direction.

Whenever the epigastric type of angina pectoris occurs it is well to seek an explanation in two probabilities: (1) involvement of the abdominal aorta, especially at the point of origin of the cœliac axis; (2) coincident disease of the stomach itself (chronic gastritis, ulcer, atony, etc.).

The possibility of sclerosis of the gastric arteries must also be considered.

It is important to determine whether or not the initial epigastric pain is truly gastric or hepatic in nature (as by hepatic congestion or cholelithiasis) and whether the angina pectoris is thereby secondarily initiated.

There are two chief types of radiations, which, by the way, may be entirely absent at the beginning, and occur only later in the disease.

1. *The symmetrical type.* Radiations which are equally severe in both shoulders, both arms (especially the ulnar surfaces) in the scapular region, both sides of the neck, both sides of the jaw and both temples.

2. *The asymmetrical type,* which involves chiefly the left side of the body; radiations occurring into the left shoulder and the left arm, the back between the vertebral column, the left shoulder blade and the left side of the neck.

While there are cases in which there is a complete absence of radiation there are, on the other hand, cases in which the attack begins in the peripheral zone and centers towards the aorta (for instance, from one carotid artery or from one arm).

These unusual peripheral types (sensations in the regions of the teeth, wrist, olecranon, etc.) are of the greatest practical importance, since they are so easily misinterpreted, and may in many cases be the forebodings of sudden death.

A patient of mine stated that the initial symptom was a peculiar drawing sensation in the little finger of the left hand, which was particularly apt to come on while walking.

In the histories of the patients with chronic aortitis and coronary sclerosis we may often trace the earliest beginnings of the fully developed attacks to stages where there were centrally localized pains only. These early stages consist usually in slight, hardly noticeable, sensations of pressure behind the lower part of the sternum, or occasional mild, stabbing pains in the heart produced by rapid motion, occurring especially in the morning. From these very slight beginnings there gradually develops the terrible picture of a severe angina. The intervals between the attacks decrease and slighter stimuli suffice to induce them.

The basis for the causative factors consists in the increased blood pressure and secondary distention of the diseased aortic walls, and upon the nerve endings embedded in them. The more frequently the attacks occur, the more slight the stimuli necessary for attacks become, the more serious is the prognosis. The prognosis is especially bad in cases where the attacks are accompanied by great nausea. The secondary symptoms which are most important in rapid diagnosis are an accentuated, ringing second aortic sound, increased tension in the arteries, and angiosclerotic pallor of the face. Gout and syphilis are commonly found in the past history.

Disease of the Aortic Valves (Endocarditis) without Disease of the Aortic Wall.—There are unquestionably cases of aortic pain corresponding in their localization and general behavior with the pains which we have described, without the presence

of any traceable disease of the aorta itself or the coronary arteries. In some of these cases there may be simply diseases of the aortic valves, in others even these may be absent. Such cases give striking proof of the nervous origin of angina pectoris and aortic pain in general. The origin of the pain in such cases is unquestionably in the cardiac and aortic plexuses of the sympathetic system. In organic disease of the aorta these may be the sites of actual neuritis and, therefore, react acutely to injury, to disturbances of the circulation in the vasa vasorum, or especially to distention of the aortic walls. They may, on the other hand, without traceable anatomical reason, be the seats of neuritis, especially in persons who are subject to general irritability of the nervous system. Such attacks of pain may be known as functional angina or false angina; but we must clearly understand that while the special pathological changes in these conditions are very different, the general origin of the pains may be much the same.

The stimulus initiating such attacks of functional aortic pain, therefore, may often be increase of blood pressure, due to spasms in the peripheral vessels. It is certainly not a chance occurrence that functional angina is found most frequently in young neurasthenic individuals with disease of the aortic valves. The neurotic disposition prepares the field and the pathological pressure in the aorta gives the actual stimulus.

The differentiation between functional and organic angina pectoris is of extreme prognostic importance and is recognized by the analysis of the factors initiating an attack and of the secondary symptoms. As far as the initiating stimuli are concerned, however, it is quite important to remember that both the conditions have many of these in common.

As for angina pectoris which is based upon actual organic disease, we may say that we are dealing with an exact problem. The patient himself knows that if he runs a certain distance at a definite speed he will have an attack. He can make a definite calculation, as it were, of the factors which will give rise to the attack.

The functional angina, on the other hand, is entirely beyond control, is irregular, and is uncertain. In all respects functional angina pectoris is a sort of farcical parody of the tragic true angina. Even the most severe cases lack the serious character of the true organic angina. The blood-pressure is not usually increased; the face is often flushed instead of pale. Instead of seriousness and quiet, there is restlessness and noise. The heart action is usually rapid.

The extremes of the two cases, therefore, are not hard to differentiate; but unfortunately a mixture of the two conditions is very common. There are cases in which a general neurosis becomes localized in the diseased aorta and adds the characters of a well-developed functional condition to the early

symptoms of a true angina. Such cases are often falsely diagnosed and are taken for pseudo-angina until sudden death occurs. No general differential symptoms can be formulated for these. Only the most careful individual study of the symptoms and the most concentrated analysis of the problem can guard us against error.

Functional angina is especially likely when we are dealing with neurasthenic patients below thirty, when syphilis can be excluded, and especially when there is excessive use of tobacco. This is likely even when an aortic valvular lesion is present. Above thirty, and especially above forty, the differential diagnosis becomes particularly difficult.

True angina must always be considered most seriously, even in the presence of neurotic symptoms, when there is arterial tension, a history of syphilis, or when gout or rheumatism is present.

PERIPHERAL VESSELS.

It is well known and based on many clinical observations that severe pains may be caused by disease of the peripheral arteries, veins, or lymph vessels. It would be quite incomprehensible if this were not the case, since the nerve trunks themselves possess their own vessels, and it goes without saying that when these are diseased, either primarily or secondarily, errors of nutrition must occur in the nerves, and these therefore become the seats of pain.

In this connection the very intimate relations between the vessels and the nerves must be carefully

considered. On the other hand, changes in the vessels and circulation may cause disease in the nerves, while disease in the nerves may cause disease in the vessels. The pathogenesis of the pains, therefore, is extremely difficult to determine.

Clinical experiment alone can lead us to the correct interpretation. It is a fact that subjective and objective pains occur along the peripheral vessels when they are involved in inflammations (phlebitis, lymphangitis, arteritis), and there is no reason for not interpreting such pains as irritability of the sensory fibers supplying the vessel walls. In some cases, of course, it is necessary to think of a direct extension of the inflammatory process from the vessels to the nerves which accompany them. Many cases of neuralgia are probably traceable to such changes in the vessels accompanying the involved nerves.

It is unquestionable that sclerotic changes in the peripheral arteries, both in the extremities and in the internal organs, may give rise to acute neuralgic attacks of pain. The most striking and fundamental example of this is Charcot's intermittent claudication, since this can be directly observed.

After a few minutes of walking the patient has pains in his calves which force him to stand still. The pain then disappears; the patient continues his walk, but in a few moments the same symptoms occur; and with the absolute regularity of a well-planned experiment the same symptoms follow the same exertion again and again.

Physical examination in these cases shows sclerotic changes in the vessels, either local with the formation of aneurysm, or diffuse changes in the iliac arteries extending downward with or without stenosis, or more or less severe vasomotor phenomena (coldness, pallor, redness and cyanosis of the toes); death finally occurs with gangrene of the toes.

The mechanism of the pain in these cases is not easy to explain. Are we dealing with chronic nutritional disturbances in the sensory nerves which reach their greatest height during the circulatory changes accompanying muscular action, or are we dealing with acute ischemia of the active masses of muscle due to arterial spasms?

The mechanism of the pain is not necessarily uniform. But, at any rate, it is certain that the clinical observations cannot be explained without the assumption of vascular spasms, to which sclerotic vessels are always subject. Otherwise the constancy of the anatomical changes would have to be followed by a constancy of the clinical symptoms, while as a matter of fact clinical experiment teaches us that proper treatment may often give the most remarkable results in a short time. Improvement may even occur spontaneously.

This unquestionably functional factor in the causation of intermittent claudication makes it almost impossible to deduct the cause of a given pain from definite anatomical conditions of the arteries. Unquestionably severe atheroma may be pres-

ent in the vessels of the leg without the existence of any pain. For this reason, even in cases where angina pectoris has been observed during life, it is not always a foregone conclusion that the finding of coronary sclerosis at autopsy absolutely explains the symptoms.

The pains occurring in intermittent claudication, too, find their analogy in diseases of the viscera.

It may be considered an established fact that diseases of cardiac, gastric, or intestinal arteries may give rise to painful interferences with function.

In order to draw an intelligent parallel, however, between the intermittent claudication of the lower extremities and the pathological conditions of internal organs, we must consider only those cases in which there is real similarity between the existing stimulus and the therapeutic influences. The attacks of pain must occur at the height of the muscular exertion, that is, at the height of digestion, as in arteriosclerotic intestinal pains, and be accompanied by disturbance of motility in the sense of spasm and loss of function.

In the heart this might become evident by cardiac insufficiency with arhythmic feeble pulse. In the intestine it might be noticed as a stenosis or distention which could simulate peritonitis; and this, as a matter of fact, actually occurs in a number of cases.

It is true, too, that cases of this order can be therapeutically influenced (erythrol tetranitrate).

Probably in all these conditions the organic basis of the pains consists in an active intermittent spasm of the vessels.

Either in the last stages of these conditions or even as an entirely independent condition, pains may occur in which the vessels play a more passive rôle. Closure of the vessels by thrombosis or embolus may give rise to pain in consequence of anæmic necrosis of the sensory nerve endings and their dependent tissue regions.

The severe pain occurring in gangrene of the toes and the sudden pains which occur in the lower extremities, with embolus or thrombosis of the lower portion of the abdominal aorta, would belong to this order.

The accompanying symptoms, coldness of the affected area and a loss of the motor and sensory functions, will usually clear up the diagnosis.

Similar processes in the chest, abdomen and viscera will, of course, give rise to great diagnostic difficulties.

Stenoses of the mesenteric arteries frequently lead to the erroneous diagnosis of intestinal obstruction and peritonitis. Whenever sudden colicky pains, either with or without bloody diarrhœa, occur in patients with noticeable arterial disease, it is always important to think of the possibility of disease of the mesenteric vessels.

Closure of the veins as well as of the arteries may give rise to severe pains. A notable example of this is the headache accompanying thrombosis of the lateral sinus, and the phlegmasia alba dolens following closure of the large veins of the leg.

CHAPTER X.

Cutaneous Tenderness in Visceral Disease.

While the fact that diseases of the internal organs may be accompanied by areas of cutaneous tenderness or pain more or less remote from the actual seat of disturbance had previously been commented on by various observers, notably Hilton, Dana, Ross, and Mackenzie, it is largely through the brilliant researches of Henry Head that the real significance of this phenomenon has been made clear. His explanation for this transference of sensation is that a painful stimulus to an internal organ causes centripetal impulses, ordinarily below the threshold of consciousness, to be conducted to a certain segment of the spinal cord. Here a more or less diffuse disturbance is induced which involves also the fibres connecting a definite district of the surface of the body with the same segment. As the function of sensation has been very highly developed in the skin its sensory and localizing power is enormously in excess of that of the viscera, so that the painful sensation is referred in consciousness not to its true source, but to the site from which such messages are habitually received,—*i.e.*, the surface of the body. According to the intensity of the visceral stimulus, actual pain may be experienced, or there may result only a state of hyperæsthesia or hyperalgesia which

manifests itself by an increased susceptibility to stimuli, so that contacts which would ordinarily evoke only sensations of touch now give rise to actual pain. In order to discover the presence of such areas of tenderness and ascertain their boundaries, the examiner may use a pin with a round head of such size as to feel blunt when applied to normal skin. Pressure is made with this here and there over the suspected region, and if hyperalgesia exists the patient complains of a sensation as if a bruised spot were touched, while if the point of the instrument is applied the pain is far in excess of that normally produced.

Head was led to investigate the subject by the observation that the distribution of the lesions in cases of herpes zoster corresponded with the areas of cutaneous pain or tenderness occurring in certain visceral disorders, and by comparing the areas involved in a large number of cases of herpes zoster with the disturbances of sensation in a series of cases of nervous disease with gross lesions of the spinal cord, he was able to map out on the surface of the body the skin units or dermatomes in communication with the various segments of the cord. These areas correspond, not to the peripheral distribution of the posterior roots, but to the segments of the cord itself from which the roots in part arise. The skin areas as traced by Head on the trunk form more or less horizontal zones of irregular outline, while about the neck and on the limbs their eccentricity of contour is still more pronounced. The

whole area is not necessarily involved in every case, but each segmental district possesses one or more maximal points in which the tendency to exhibit pain or tenderness is most acute and which give the clue to the area concerned.

Subsequent observers have verified Head's conclusions in most particulars, and while the limits of the various areas as given by different authors do not in all cases coincide absolutely, it is probable that the maximal points on Head's diagrams are correct. For practical purposes, at any rate, the chief interest attaches to these, so that for this reason, and for the sake of greater clearness, on the following figures only the so-called maxima are indicated. It must be remembered, however, that for the present at least, the evidence afforded by the demonstration of areas of cutaneous tenderness or pain is valuable chiefly in the positive sense and that their absence does not preclude the existence of visceral disease. Furthermore, in any given case these areas do not necessarily preserve their integrity indefinitely, but as the nervous system becomes impaired as the result of prolonged illness, first, the corresponding district of the opposite side of the body may become involved and later on still more marked generalization may occur until the pain and tenderness invade areas that bear no relation to the affected organ. A point of practical importance is that counter-irritation over the cutaneous area may have therapeutic value, not only in the immediate relief of pain, but also in influencing the underlying condition.

In this connection Mackenzie's acute observations and conclusions deserve mention. It is generally conceded that visceral disorders can give rise to so-called somatic or referred pains through the mechanism explained above, but it is also held, as a matter of course, that actual pain can be experienced in the organ itself. Mackenzie, however, denies the existence of this splanchnic pain and contends that the pain of visceral disease is not felt as such in the organ, but is referred to the peripheral distribution of the cerebrospinal nerves in the external body wall. Through an error of subjective localization the sensation is then interpreted as having its site in some adjoining internal structure, for example the stomach in gastric ulcer, or the heart in angina pectoris.

SEGMENTAL DISTRIBUTION OF REFERRED PAIN AND TENDERNESS IN VISCERAL DISEASE.

(Compiled from Head.)

See diagrams figures 1, 2, and 3.

Heart.—Third cervical and first, second, and third dorsal segments.

Lungs.—Third and fourth cervical and first to ninth [sometimes tenth] dorsal segments, especially the third, fourth, and fifth.

Breast.—Fourth and fifth dorsal segments.

Œsophagus.—Fifth, sixth, and eighth dorsal segments.

Stomach.—Third and fourth cervical and sixth, seventh, eighth, and ninth dorsal segments. Cardiac end from the sixth and seventh, and the pyloric end from the ninth.

Intestines.—Down to the upper part of the rectum: Ninth, tenth, eleventh, and twelfth dorsal segments. Rectum: Second, third, and fourth sacral segments.

Liver and Gall-bladder.—Seventh, eighth, ninth, and tenth dorsal segments, and perhaps the sixth.

Kidney and Ureter.—Tenth, eleventh, and twelfth dorsal segments. The nearer the lesion lies to the kidney the more is the pain and tenderness associated with the tenth dorsal segment. The lower the lesion in the ureter the more does the first lumbar segment tend to appear.

Bladder.—Mucous membrane and neck of the bladder: First, second, third, and fourth sacral segments. Overdistention and ineffectual contraction: Eleventh and twelfth dorsal and first lumbar segments.

Prostate.—Tenth, eleventh, and twelfth dorsal, first, second, and third sacral, and third lumbar segments.

Epididymis.—Eleventh and twelfth dorsal and first lumbar segments.

Testis.—Tenth dorsal segment.

Ovary.—Tenth dorsal segment.

Uterine Appendages.—Eleventh and twelfth dorsal and first lumbar segments.

Uterus.—In contraction: Tenth, eleventh, and twelfth dorsal and first lumbar segments. Os uteri: First, second, third, and fourth sacral segments, and very rarely the fifth lumbar.

ASSOCIATED PAINFUL AREAS ABOUT THE HEAD RELATED TO VISCERAL DISEASE.

(Head.)

See diagram figure 4.

Area on Body.	Associated Area on Head.	Organs in Particular Relation with these Areas.
Cervical 3 and 4	Fronto-nasal....	Apices of lungs, stomach, liver, aortic orifice (?)
Dorsal 2 and 3 .	Mid-orbital	Lung, heart, arch of the aorta.
Dorsal 4	Doubtful	Lung.
Dorsal 5	Fronto-temporal.	Lung and occasionally the heart.
Dorsal 6	Fronto-temporal.	Lower lobe of lung, and heart.
Dorsal 7	Temporal	Bases of lungs, heart, and stomach.
Dorsal 8	Vertical	Stomach, liver, and upper part of the small intestine.
Dorsal 9	Parietal	Stomach, and upper part of the small intestine.
Dorsal 10	Occipital	Liver, intestine, ovary, and testicle.

AREAS OF REFERRED PAIN AND TENDERNESS IN AFFECTIONS OF THE HEAD AND NECK.

(Head.)

See diagram figure 4.

Organ Involved.	Maximum Point of Referred Pain and Tenderness.	Organ Involved.	Maximum Point of Referred Pain and Tenderness.
Ciliary muscle. (Disorders of accommodation.)	Midorbital.	Upper teeth...	Frontonasal, nasolabial, temporal, maxillary, or mandibular.
Cornea	Frontonasal.	Lower teeth...	Mental, hyoid, superior laryngeal, and in the ear.
Iris	Frontotemporal, temporal, and maxillary.	Tongue, anterior part.	Mental.
Vitreous body (Glaucoma.)	Temporal.	Tongue, lateral part.	Hyoid, superior laryngeal, and in the ear.
Retina	Vertical.	Tongue, posterior part.	Superior laryngeal, hyoid, occipital.
Tympanic membrane.	Hyoid.	Tonsil	Hyoid and in the ear.
Middle ear	Vertical and behind the ear.	Nose, olfactory portion.	Frontonasal and midorbital.
		Nose, respiratory portion and posterior nares.	Nasolabial (occasionally).
		Larynx	Superior and inferior laryngeal (in destructive lesions).

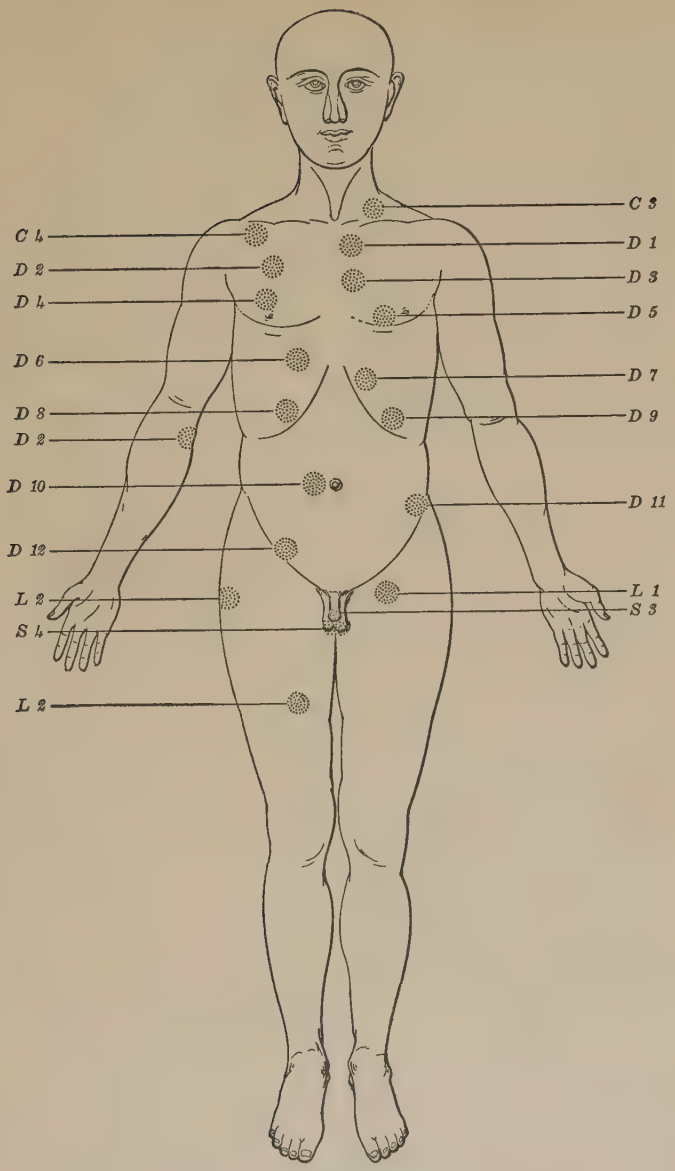

FIGURE 1.—*C 3* and *C 4*, third and fourth cervical; *D 1* to *D 12*, first to twelfth dorsal; *L 1* and *L 2*, first and second lumbar; *S 3* and *S 4*, third and fourth sacral.

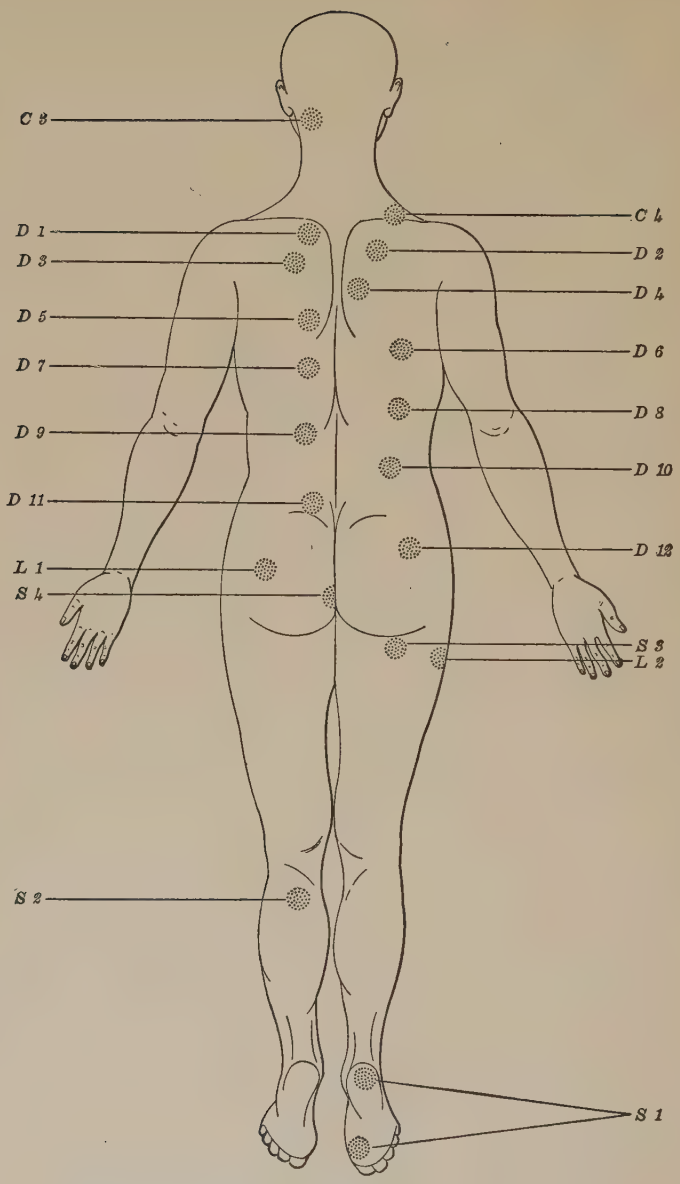

FIGURE 2.—*C*, cervical; *D*, dorsal; *L*, lumbar; *S*, sacral.

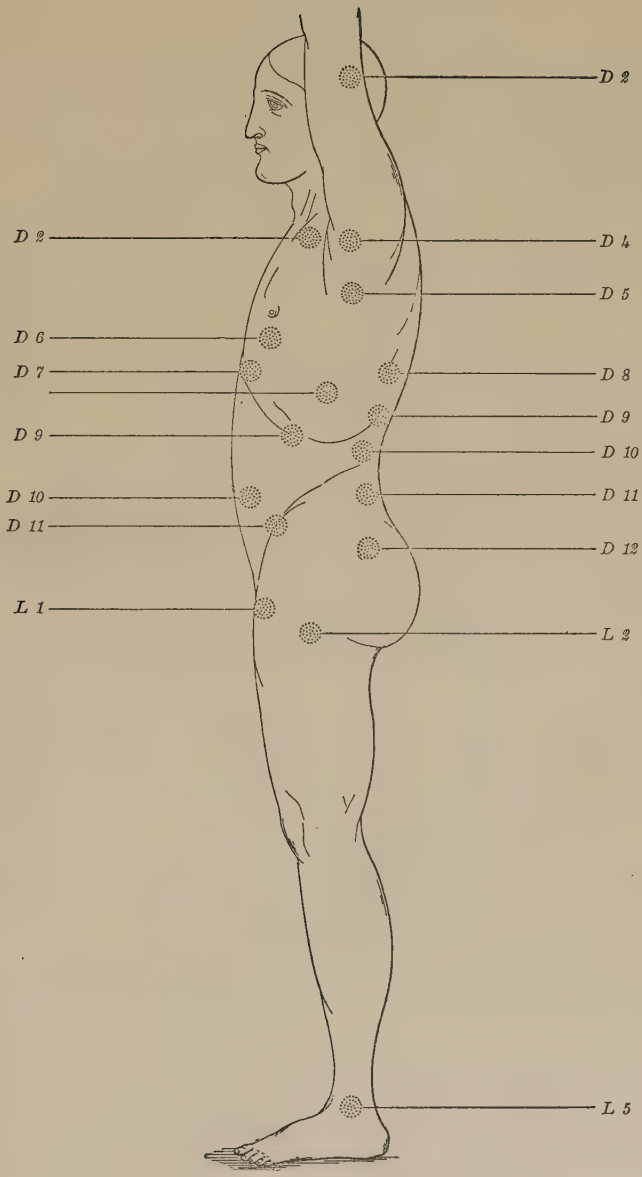

FIGURE 3.—*D*, dorsal; *L*, lumbar.

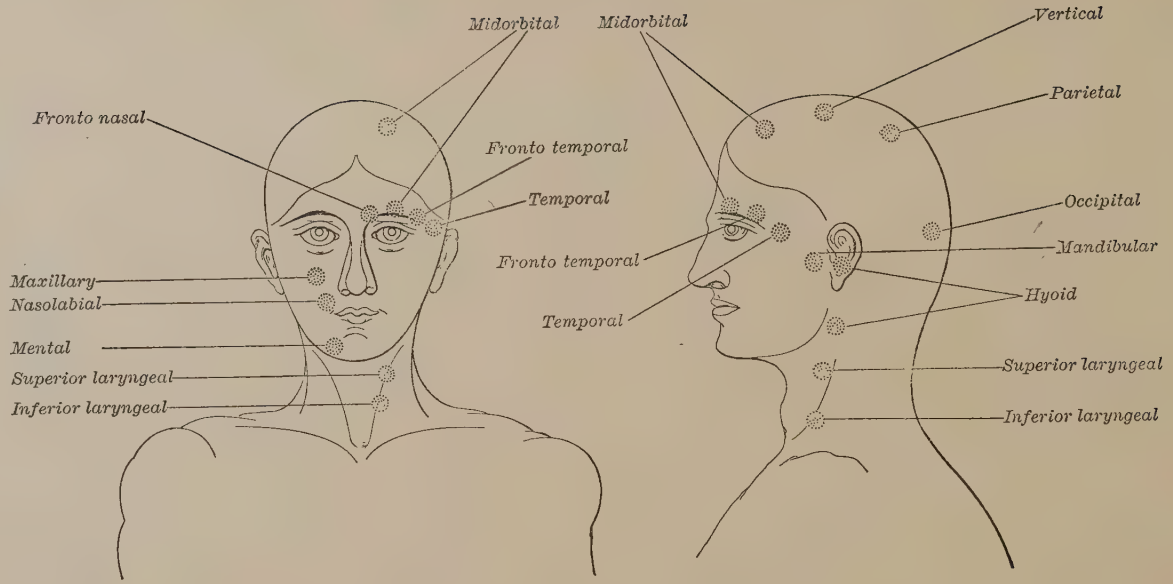
Midorbital
Midorbital
Vertical
Parietal
Fronto nasal
Fronto temporal
Temporal
Occipital
Mandibular
Fronto temporal
Hyoid
Maxillary
Nasolabial
Temporal
Mental
Superior laryngeal
Superior laryngeal
Inferior laryngeal
Inferior laryngeal

FIGURE 4.

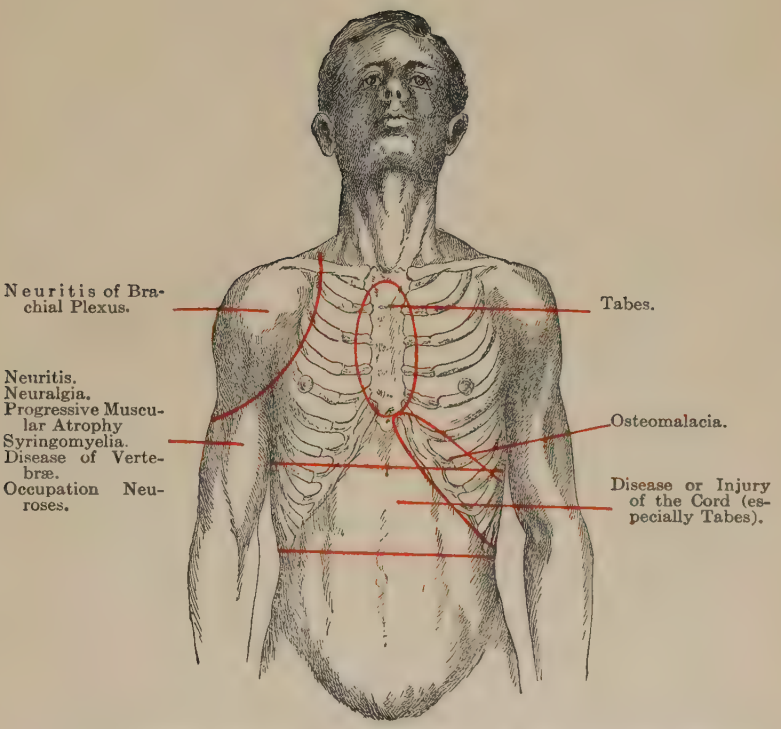

FIGURE 5.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE NERVOUS SYSTEM, ETC.

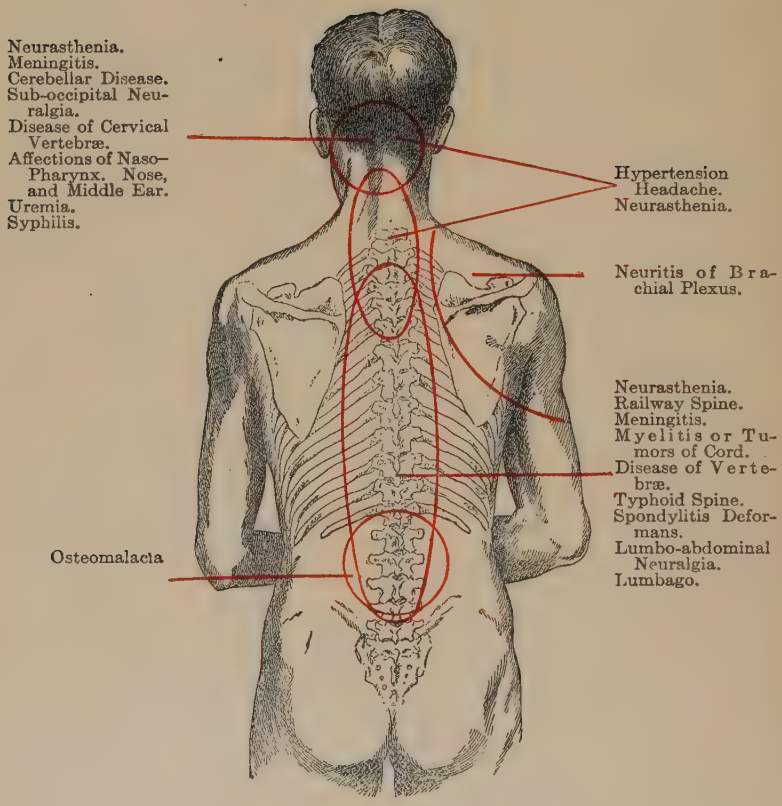

FIGURE 6.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE NERVOUS SYSTEM, ETC.

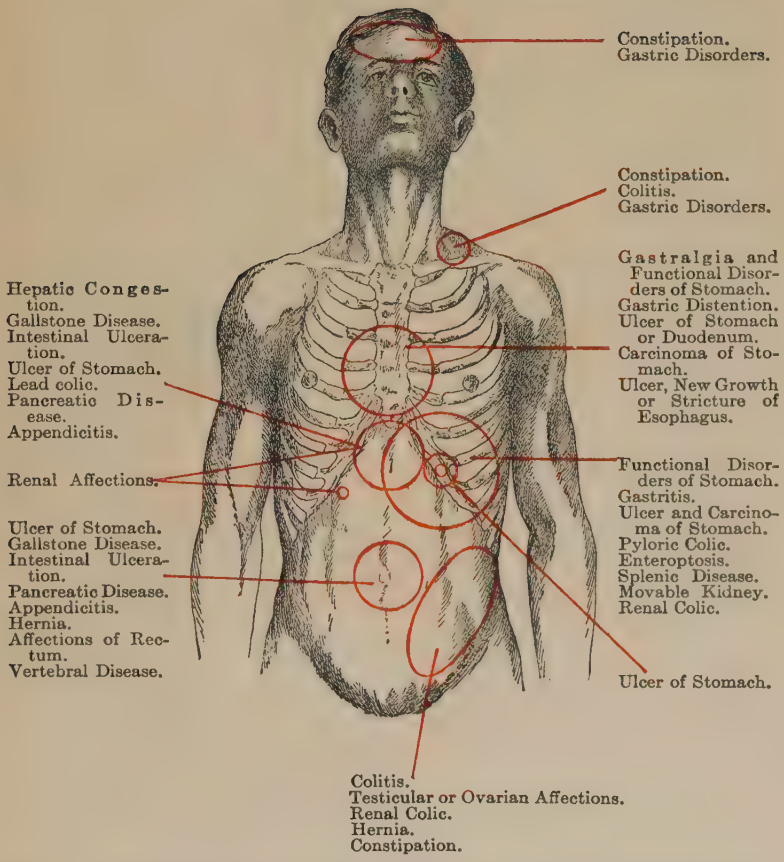

FIGURE 7.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE ABDOMINAL ORGANS.

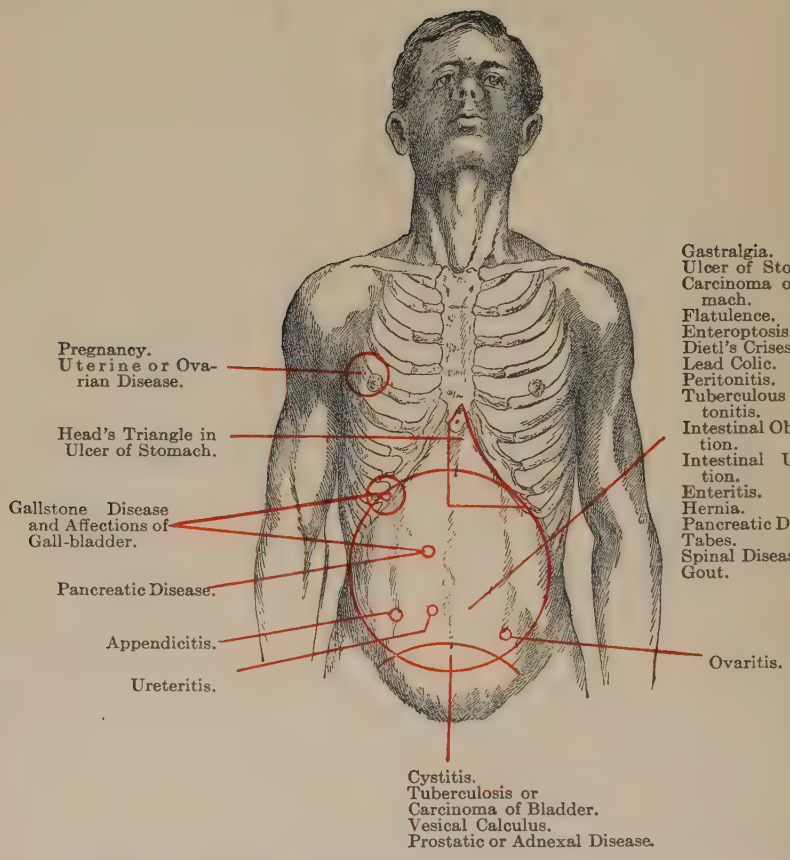

FIGURE 8.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE ABDOMINAL ORGANS, ETC.

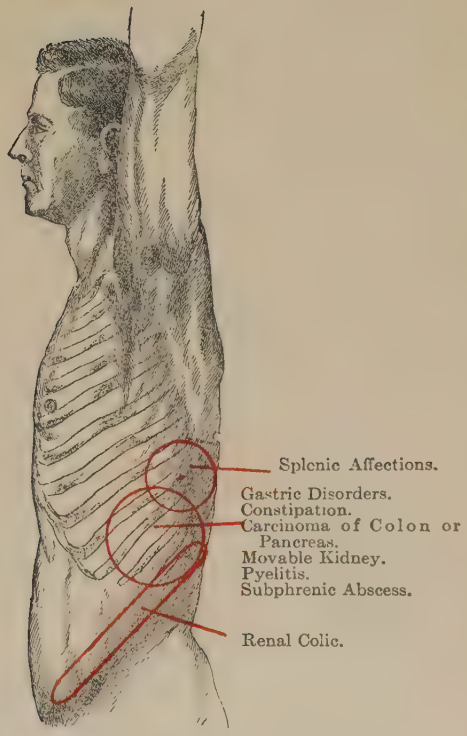

FIGURE 9.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE ABDOMINAL ORGANS.

Gallstone Disease and Affections of Gall-bladder.
Hepatic Disease: Cirrhosis, Congestion, Syphilis, Carcinoma, Abscess, Echinococcus etc.
Subphrenic Abscess.
Carcinoma of Pylorus or Colon.
Movable Kidney.
Pyelitis.

FIGURE 10.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE ABDOMINAL ORGANS.

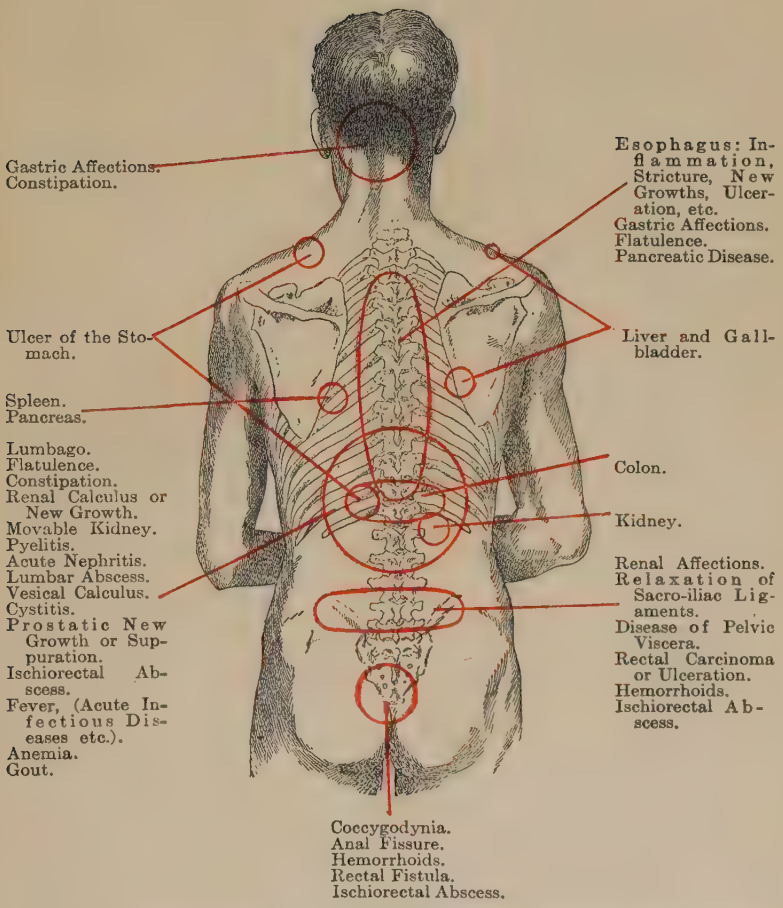

FIGURE 11.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE ABDOMINAL ORGANS, ETC.

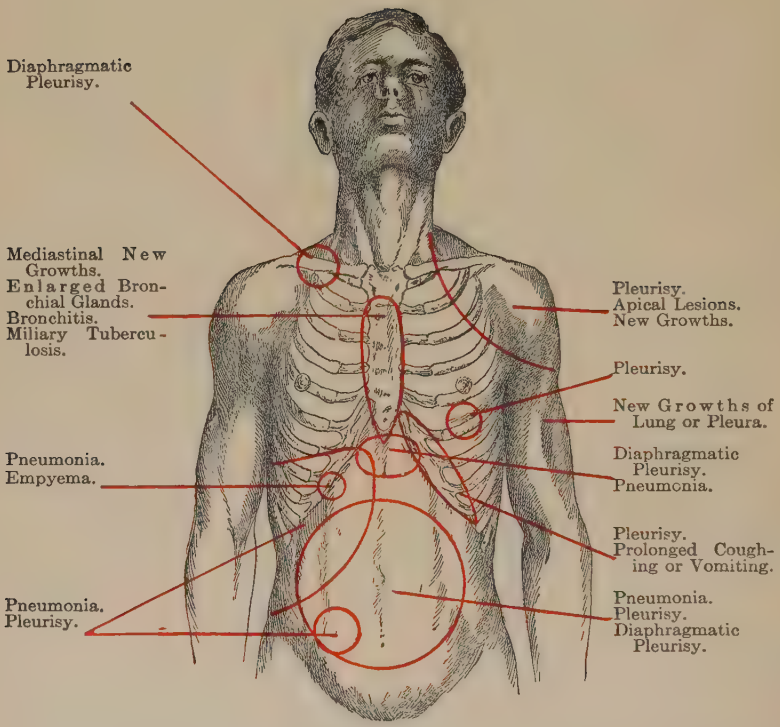

FIGURE 12.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE LUNGS AND PLEURA.

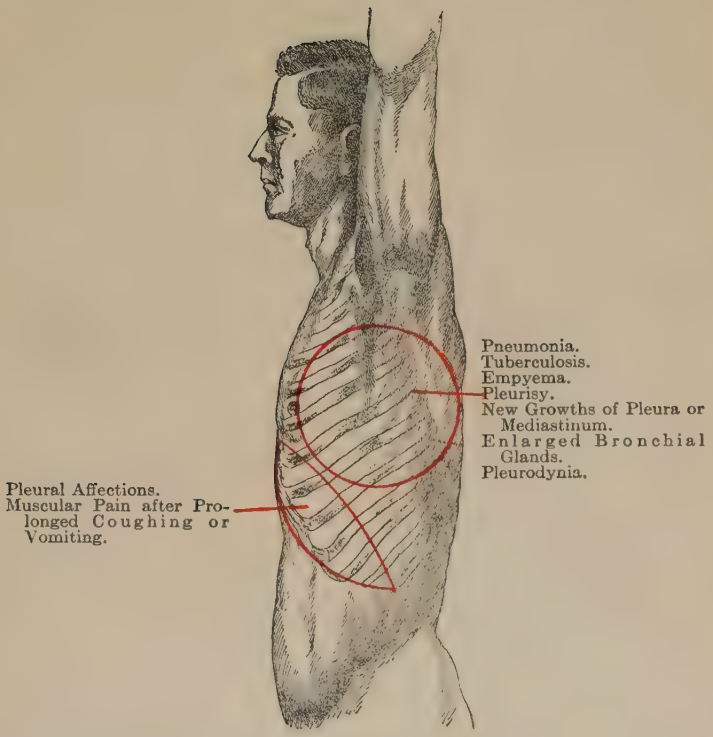

FIGURE 13.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE LUNGS AND PLEURA.

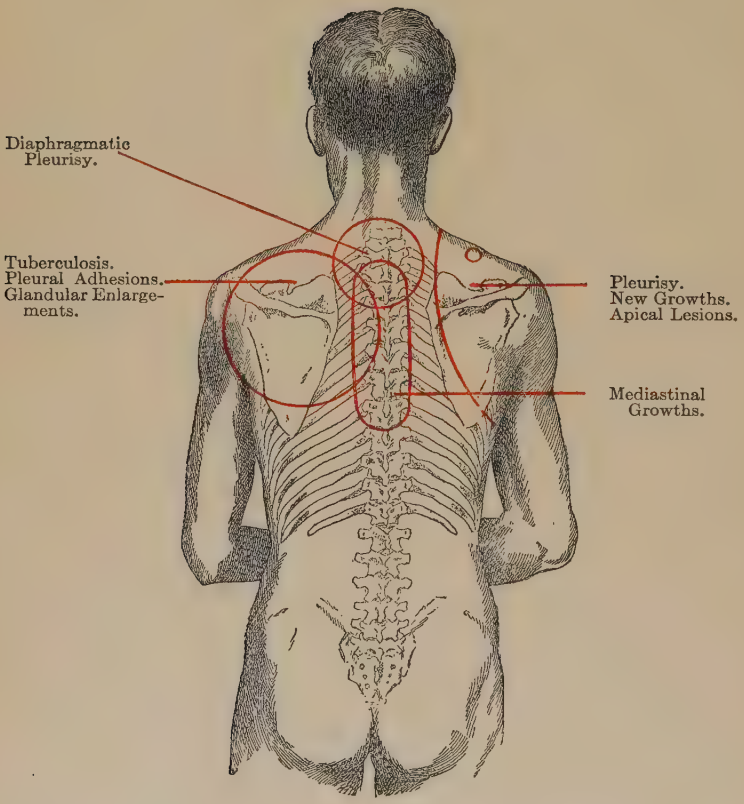

FIGURE 14.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE LUNGS AND PLEURA.

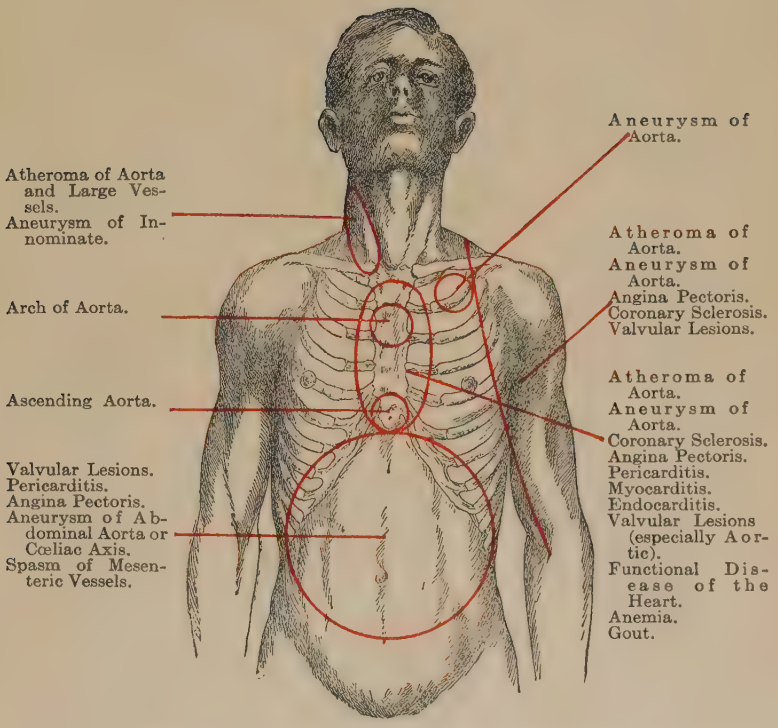

FIGURE 15.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE HEART AND VESSELS.

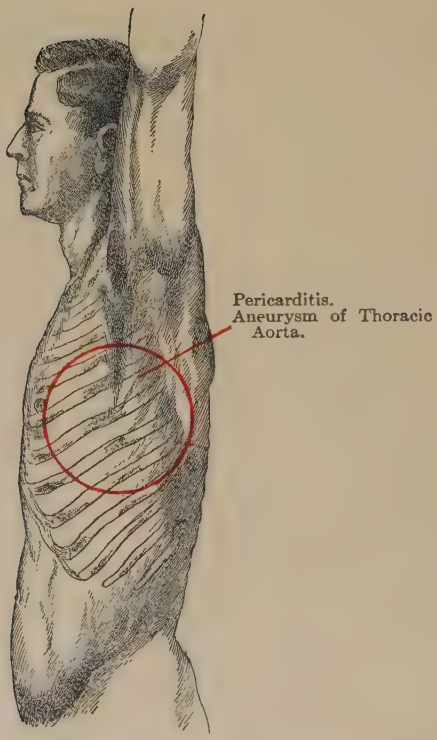

FIGURE 16.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE HEART AND VESSELS.

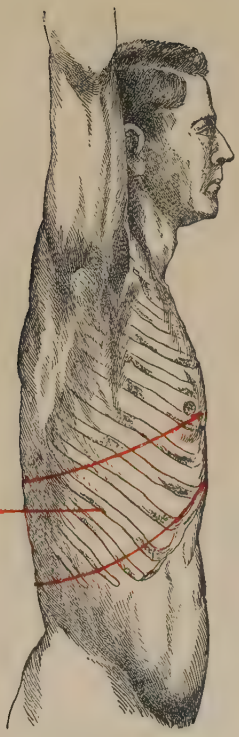

FIGURE 17.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE HEART AND VESSELS.

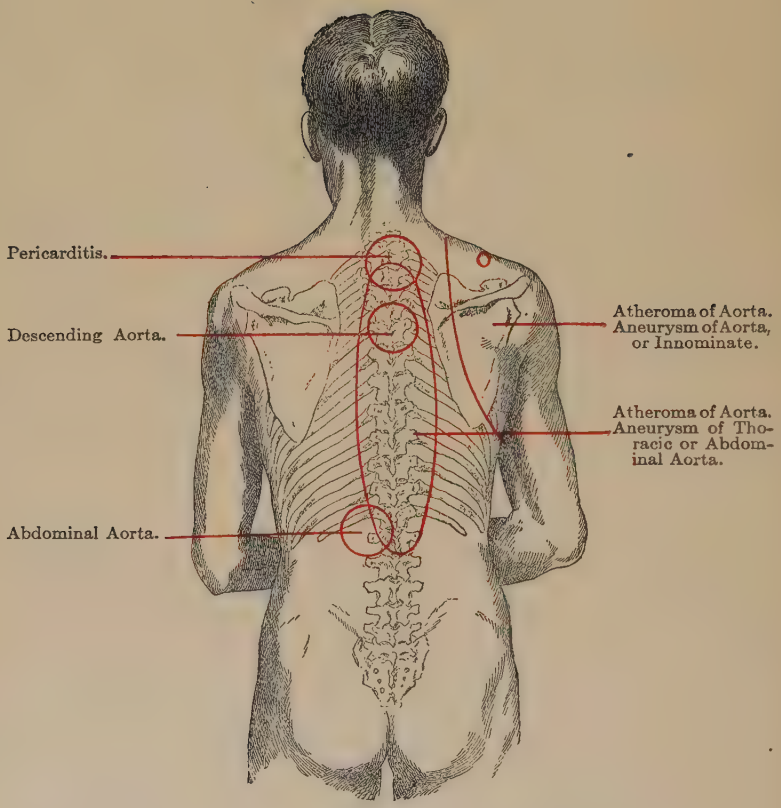

FIGURE 18.—POSSIBLE AREAS OF PAIN OR TENDERNESS IN DISEASES OF THE HEART AND VESSELS.

INDEX

Abdomen, 60
Abdominal disorders, 30, 44, 63, 109
Adhesions, peritoneal, 272
Anæmia, 87
Aneurysm of aorta, 344
Angina pectoris, 41
Aorta, 52, 322
Aortitis, chronic, 339
Apices, pulmonary, 51
Appendicitis, 248
Appendix, 206
Arm, 105
Arthralgias, 119

Biliary congestion, 261
Brain tumor and hydrocephalus, 79

Calculi, 275, 292
Cancer, gastric, 187
Carcinoma of colon, 249
    of gall-ducts, 266
Catarrhal and ulcerative changes in bladder and urethra, 302
Circulatory apparatus, 29, 53
Cirrhosis of the liver, 306
Colic, 57
    and thoracic processes, 63
    doubtful cases of, 73
Colicky pains, 71
Collapse, 57
Congestion, hæmatogenous, 256
Cysts, 269

Defecation, 45
Deglutition, 47
Drugs and chemicals, 41, 310

Embolism of the renal arteries, 278
Epigastrium, 56, 57, 271
    midline of, 238
Epigastric pain, 30

Face, 102
Food, influence of, 36, 57

Gall-bladder, 238
    colic, 236
Gall-stones, 69
Gastralgias, 140
Gastric crises, 46
    disorders, 55
    pain, 43

Hemorrhage, 275, 301
Headache, 76
    and constipation, 81
    caused by chemical poisons, 85
    of reflex nature, 88
Hæmoglobinuria, paroxysmal, 307
Heart or epigastrium, 41
Heart disease, 307
Hernias, 68
Hysteria, 251

Infectious processes, 307
Inflammations of aorta, 323
Intercostal spaces, 107
Intestine, malignant new growths of, 224
Intestinal stenoses, 68, 197
    ulceration, 197

Kidney, 250, 277, 284, 299

Lead colic, 217

Lead colic, individual symptoms and analysis, 218
Lesions, abdominal, 45
aortic, 326
of lungs, 321
organic, 40
Liver, 52, 54, 233
capsule, distention of, 235
inflammatory processes, 235, 256
Lumbar region, 61, 63, 239
Lungs, 312

Mediastinum, 53
Menstruation, 48
Motion, organs of, 28
Myalgias or muscular pains, 124, 128, 129
Myelogenous leukæmia, 306

Nephritis, 284
Neuralgias, 67, 97, 100, 107, 110
New growths, cystic, 65
Nocturnal pains, 73

Obstruction, intestinal, 273
Occipital region, 104
Œsophagus, 54
Osteomalacia, 136
Ostalgias or bone pains, 131, 139

Pain, sensation of, 15–21
of colic, 71
Pancreas, 268, 274
Percussion, 34
Peripheral vessels, 345
Perivesical inflammations, 302
Pleura, 314, 321
Pleural pain, 316
Pneumonia, 322
Position, 24, 58, 80
Pressure, 32, 280
Pyelitis, 298
Pyloric stenosis, colic of, 175

Renal infarct, 281, 284
Respiration, 49
Retrosternal region, 53

Scapula, and intrascapular region, 54
Shoulder, 51
Spasm in bile-passages and gall-bladder, 233
of the urogenital tract, 291
Spleen, 306
Stenotic processes, 291
Stomach, 54
and intestine, 90
Suppurative processes, 31

True kidney pains, 277
Tuberculosis of the kidney, 287

Ulcer, duodenal, 248
gastric, 154
Ulceration, gastric and duodenal, 42
intestinal, 197
tuberculous intestinal, 186
Uremia, 85
Urinary bladder, 302
Urination, 282

Vagus, 113
Valves, aortic, 342
Visceral disease, 350–355
Vomiting, 47

A SANE, SCIENTIFIC, AND INSPIRING BOOK

WHY WORRY?

By GEORGE L. WALTON, M.D.

Frontispiece. 12mo. 275 pages. Cloth, $1.00 net.

THIS book is no cure-all, but it has a sane hopefulness that should make it one of the most helpful works ever written upon the topic of worry. Never has a subject been treated with a fuller combination of professional knowledge, common sense, clear, concise, and pointed language. This is a book to read and to recommend to your neighbor, as it will prove an inspiration to any one who has found himself curtailing his physical energy by worries, futile or needless.

"A well-thumbed copy in every household where there is the slightest inclination to worry would mean a great addition to the world's present stock of happiness and contentment." —*Philadelphia Press.*

"People who overwork and worry, who consider themselves misunderstood, or what is commoner and far worse, who make themselves wretched by the habit of self-depreciation and introspection, should by all means read this sympathetic book."
—*Chicago Evening Post.*

J. B. LIPPINCOTT COMPANY
PUBLISHERS PHILADELPHIA

W. B. MEACHAM.

W. B. MEACHAM.